Nordic Project on Development and Implementation of Environmental Performance Indicators in Industry

Methodological approach for development of indicators for strategic decision making in industrial companies

December 2000

Johan Thoresen
Østfold Research Foundation (STØ), Norway
Elin Eriksson
Chalmers Industrial Technology (CIT), Sweden
Rabbe Thun
VTT, Finland

REPORT OVERVIEW

Rapport no: OR 05.01	**ISBN no:** 82-7520-412-7 **ISSN no:**	**Report type:** Research Report
Report title: Methodological approach for development of indicators for strategic decision making in industrial companies.		**Authors:** Johan Thoresen – STØ, Norway Elin Eriksson – Chalmers Industriteknik, Sweden Rabbe Thun – VTT, Finland
Project no: 231903	**Project heading:** Nordic Project on Development and Implementation of Environmental Performance Indicators in Industry	
Report employers: Nordic Industrial Fund **Employer reference**: Lise Sund		

Resymè:

A methodology has been developed for two types of Sustainable Performance Indicators (SPIs), one for strategic decision making and one for reporting purposes.

The basis for this methodology development has been a combination of literature study and actual experience gained through a series of workshops with participation from Norwegian, Swedish and Finnish industry and research institutions.

This document describes the actual methodology which has been developed in the project. Separate reports have been produced, which describe individual adaptation and implementation of SPIs into the planning processes of the individual, participating companies from the three countries.

Key words:	**Accessibility:**	**No. of pages**
* Environmental Performance Indicators * Strategic Decision Indicators	This page: Open This report: Open	(incl. appendices): 45

Godkjent
Dato: 12.02.2001

Project leader
Johan Thoresen

Project manager
Ole Jørgen Hanssen

CONTENTS

1 INTRODUCTION

Environmental Performance Indicators (EPIs) have during the past decade been taken into use by many industrial companies, in order to have qualitative and qualitative data about the environmental status of their manufacturing sites or products. These EPIs most often have been defined to supply environmental information about the company to external stakeholders (insurance companies, shareholders, NGOs, authorities, media etc.) and have mainly been based on the operational performance (OPIs), focusing on the use of raw-materials and energy, and on emissions and wastes being generated. Lately information on environmental management related issues (MPIs) has also been systematised. This EPI based information has been communicated to the public in the form of annual and environmental reports.

During the last years it has become clear that companies and other organisations need a long-term strategy which not only ensures a survival from an economic perspective but also survival from an environmental perspective. The environmental strategies and subsequent performance of some international companies (e.g. Shell Oil) have during the last five years resulted in international distrust and consequently in impact on the companies' profitability. Companies' ability to communicate the direction of their environmental strategies and trends in environmental performance both to internal decision makers and external stakeholders can be considered as a pre-requisite for future success in national and/or international business. Social responsibility and acceptance by a diversified number of stakeholders is also something that is being accentuated.

It is therefore an obvious need of developing and taking into use indicators that reflect companies' commitment to continuous improvement, and indicators that can be used for strategic decisions concerning ways forward. For both types of indicators, the broader concept of sustainable development has been introduced to describe the desired direction for future development.

Strategic performance indicators may be viewed as instruments to guide internal strategic decisions in a sustainable[1] direction in the medium to long term. EPIs for external communication purposes may on the other hand be viewed as instruments for external stakeholders to influence companies' direction of environmental strategies or the environmental performance of their products and processes.

Different techniques for capturing future environmental aspects of importance and the speed/direction of external changes surrounding the business environment may be used, depending on the strategic time perspective chosen by the company.

In this Nordic project for environmental performance indicators in industry (NORDEPE), methodologies for both types of indicators (SPIs or Sustainable Performance Indicators) have been developed and tested. This current report is one out of a set of reports from the NORDEPE project and describes mainly the methodologies which have been developed.

The report is intended as a guideline for company personnel in charge of developing and introducing sustainability indicators in their organisations. One will find that most development phases in the two methodologies coincide. The appendices are intended as complementary reading - where necessary - for the personnel and discuss more in detail the principles and practices being used in the separate case studies.

[1] The definition of sustainable development in this paper comprises environmental-, economic- and welfare development for current and future generations. This is in accordance with the World Commission on Environment and Development

(WCED, 1997).

II.

III. 2 BASIS FOR SUSTAINABLE PERFORMANCE INDICATORS

According to company needs, SPIs may be defined to represent the performance of a whole corporation, a single company, one or more manufacturing sites, portfolios of products or single products.

There are three levels of strategic decision making that are relevant:

- Business concept decisions related to the type of demands the company is trying to fulfil
- Policy decisions
- Functional strategy decisions

It is important to set a time frame for SPIs, which should be used to define strategic decisions and future planning aspects with important sustainability implications. However, it is important to define whether they will be used in decision and communication situations dealing with a short-term strategic perspective (1-3 years), a medium term perspective (4-10 years) or a long-term perspective (above 10 years).

The international political-, business- and scientific communities have during the past few years expanded the focus on the performance of corporations or individual companies. Four main areas of focus have been introduced:

- Environmental performance of industrial processes and products in a lifecycle perspective with local, trans-national and/or global impacts on the environment.
- Socio-economic effects of company performance with environmental consequences within regions or across national borders.
- Welfare effects for employees and the public outside the gates.
- The need to introduce an ethical perspective in company decisions.

Therefore main causes for undesired behaviour in all four areas should be identified and reduced or eliminated through changes of behaviour in all relevant strategic decision situations.

Several international initiatives have been trying to develop general schemes for environmental reporting purposes, e.g. the Global Reporting Initiative (GRI). GRI

suggests the reporting of sustainability parameters including social welfare, economics and the environment, or a 'triple bottom line'. ISO 14 031 EPE Standard is another initiative from the International Standards Organisation. However, some essential performance issues are lacking in the GRI and ISO framework, namely indicators to supply information about the performance of products through their entire lifecycle and indicators that define the quality of strategic decision making, planning processes and organisation of company-internal activities.

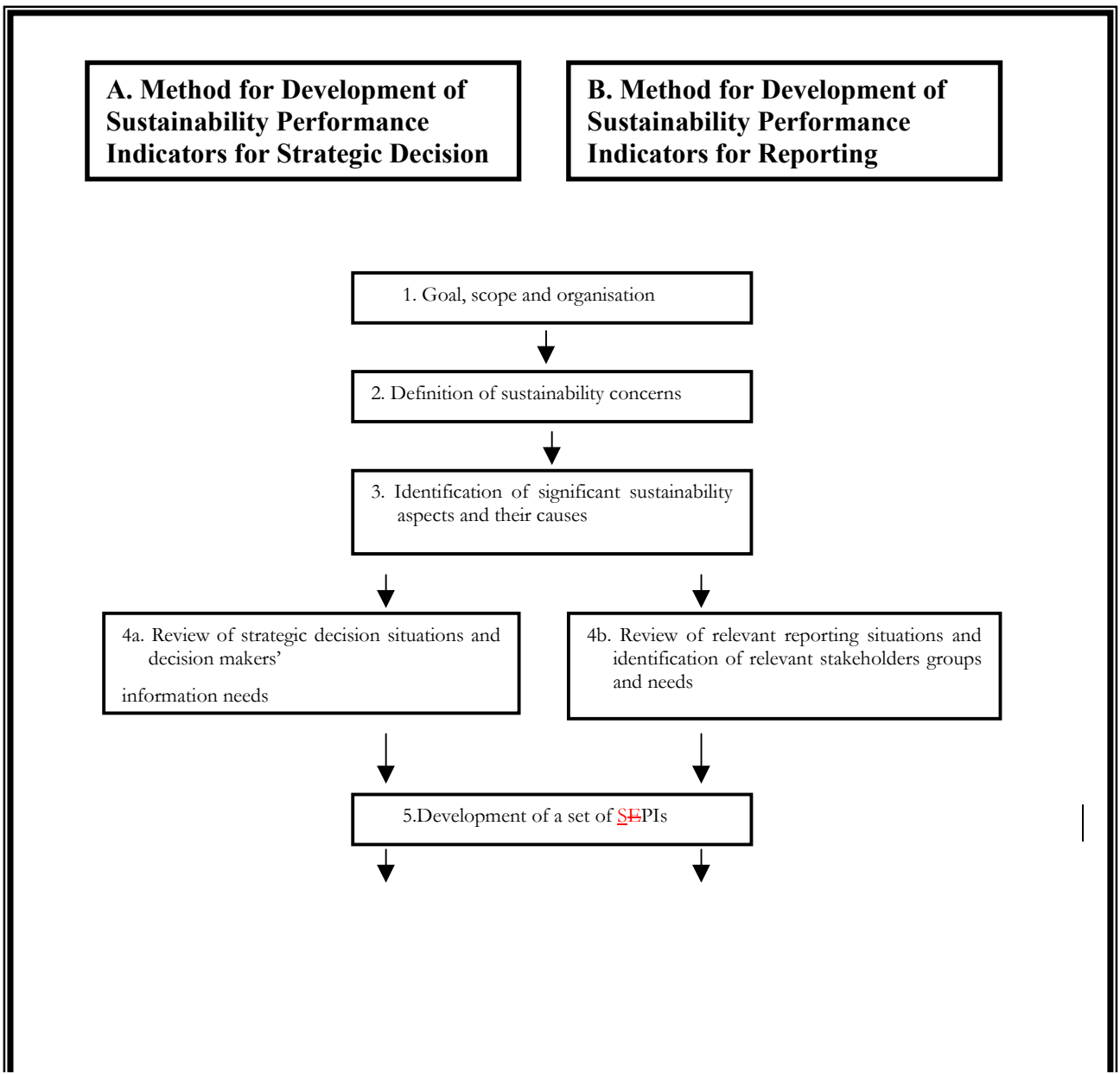
On this backdrop, a somewhat broader indicator framework for SPIs is suggested. This framework comprises the following four types of indicators:

- Product Lifecycle Indicators (PLIs) - providing information about a certain aspect of product performance through the entire lifecycle of products (eg. life cycle impact on global climate, expressed as emissions of CO2-equivalents pr. ton of product). The indicators are based on Life Cycle Assessment (LCA).
- Management Performance Indicators (MPIs) - providing information about management efforts to influence environmental performance of the organisation's total activities, *including planning processes, strategic decision making, ambitions of environmental competence development and internal organisation of activities.*
- Operational Performance Indicators (OPIs) - providing information about the environmental performance of the organisation's technical operations (eg. total CO2-equivalent emissions pr. ton of product from the manufacturing site, or water use per output and unit process in relation to BAT-level).
- Environmental Condition Indicators (ECIs) - providing information about the condition of the environment (eg. population trends for a typical 'signal species' in a lake or river).

This indicator framework may then be applied to define company environmental strategies and performance for the sustainability end effect aspects, which are further detailed in chapter 3.2.

3 METHODOLOGICAL APPROACH FOR DEFINING SPIs FOR STRATEGIC DECISIONS AND FOR REPORTING PURPOSES

The two partly coinciding methodologies are shown in figure 3.1. The phases that do not coincide are marked with the letters a. and b., where the former represents SPI-development for strategic decision making and the latter SPI-development for reporting and communication purposes. With basis in the flowchart in fig. 3.1, the different phases of the two methodologies are further explained below in this chapter.



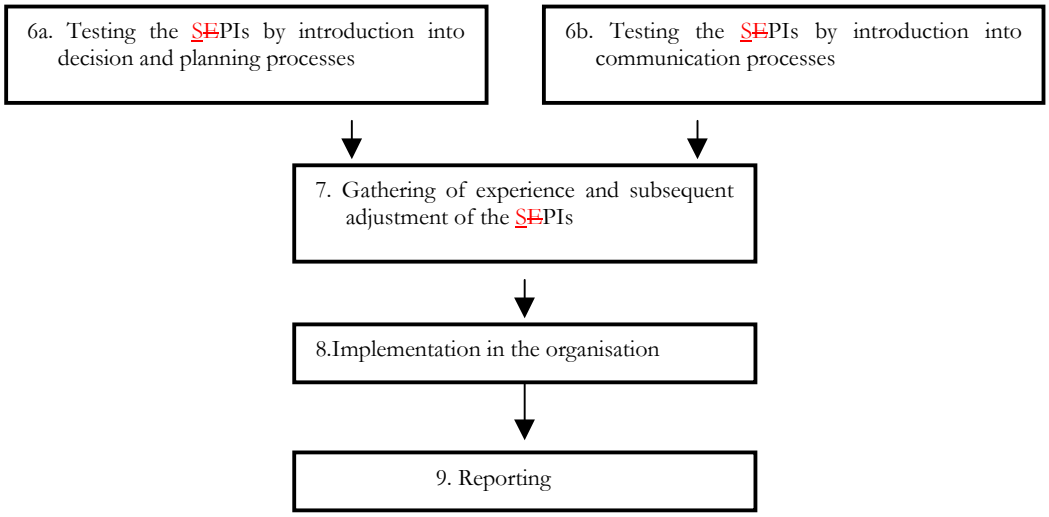


Fig. 3.1 A general flow chart of the development and implementation of SPIs to be used for A) strategic decision making and B) reporting purposes.

The different development phases are in the following text denoted by 3.1 – 3.9, where the numbers behind the period is the same as the numbers representing the different phases in fig. 3.1

3.1 Goal, scope and organisation of an indicator project within a company

The goal of the project should be to influence strategic decisions in a sustainable direction by making relevant environmental information available both to internal and external stakeholders[2]. This may be achieved by introducing SPIs as information tools for strategic decision makers at all relevant levels within an organisation and for all relevant external stakeholders.

It is suggested that a cross-functional project group is appointed to develop and secure the implementation of SPIs for strategic decision situations and external communication. The development work in the project group should invite to creativity among the participating personnel when identifying the strategic decision and communication situations which may have a significant impact on environmental strategies and performance of the companies' products and processes. Creativity is also needed to define proper indicators which may represent and show improvements in conditions of importance to main causes of environmental problems and environmental opportunities for the company in question.

To gain necessary momentum within the company, the project work should be clearly supported by the top management group.

[2] Internal stakeholders: Personnel making decisions with bearing on the company's strategic environmental performance from products and processes.

External stakeholders: Finance institutions, insurance companies, envionmental authorities, NGOs etc.

Strategic, environmental decisions may lead to undesired consequences on a local, regional or global basis. The causes of such consequences may originate from any point along the lifecycle (or product chain) for the product in question, see fig. 3.2.

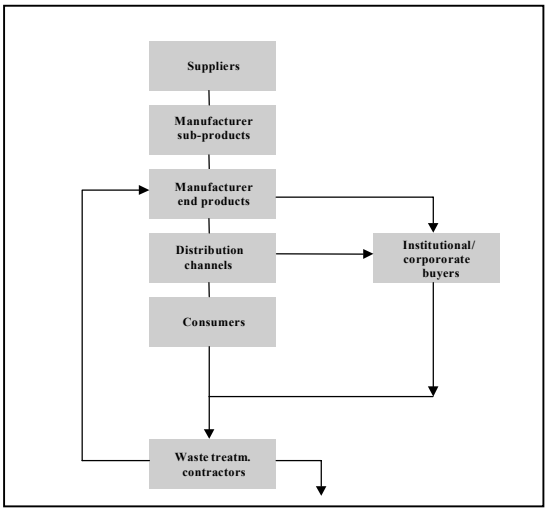


Fig. 3.2 : Simplified structure of actors along the product life cycle

The scope for indicator development and use may be defined by carefully selecting answers to the following questions:

- Where should the geographic boundary for potential company influence be drawn around the given decision issues ?
- Which life cycle actors within this selected boundary are essential for sustainable performance and therefore might be influenced through strategic decisions?
- Should we consider local, regional and/or global effects?
- What strategic time frame are we talking about? 1-3 years, 4-10 years or above 10 years?

3.2 Definition of general sustainability concerns

The following structure of indicator categories may be chosen as a basis for representing sustainability aspects in strategic decision making and communication (for more detailed information, see Appendix 1).

Table 3.1: Categories and sub-categories for significant sustainability aspects

Sustainability indicator categories and sub-categories		
Effects on resources	**Ecological effects**	**Human health effects**
Depletion of energy resources	Climate effects	Occupational health effects
Depletion of material resources (in particular non-renewables)	Depletion of stratospheric ozone	Toxicological effects off-site
Depletion of water resources	Acidification	Non-toxicological effects off-site
Depletion of land resources	Eutrophication	
	Photo oxidant formation	
	Eco toxicological effects	

Depletion of biotic resources	Habitat alterations and effects biological diversity
Social responsibility effects	**Economic effects**
Quality of management Wages and benefits Non-discrimination Training and education Child labour Forced labour Freedom of association Human rights Social performance of suppliers Social impacts from products and services	Appearent cost of effluents, emissions, resource use and disposal Social cost of effluents, emissions, resource use and disposal Donations

Sustainability concerns may also be defined through a *Backcasting or Forecasting technique* documented in App. 3 - 6.

3.3 Identification of significant sustainability aspects and significant causes of company performance

It is essential that SPIs represent the significant future sustainability aspects of the company. The selection between such aspects will depend on the time scale one considers for the effects from strategic decision making.

Short-term strategies (1-3 years) - the selection of key environmental aspects to be represented by indicators should be based on an understanding of the most important sustainability impacts from products or services provided by the company. The impacts may be obtained by carrying out a life cycle assessment (LCA) or an environmental impact assessment (EIA) on key products and processes or a cleaner production audit (CPA) of a site. A forecasting scenario technique may also be used (cf. App. 6).

Medium term strategies (4-10 years) - the selection of key environmental aspects to be represented by indicators may be based on the forecasting scenario technique (cf. App. 6).

Long term strategies (above 10 years) - the selection of key environmental aspects to be represented by indicators may be based on a backcasting scenario technique (cf. App. 3 - 5).

The understanding of cause-effect relationships is essential, when one tries to identify significant causes of significant sustainability aspects. It is strongly recommended that the project group draws up a 'cause-effect tree' or 'causality chain' to clarify the links between significant causes of environmental harm and its environmental effects for each relevant, significant aspect.

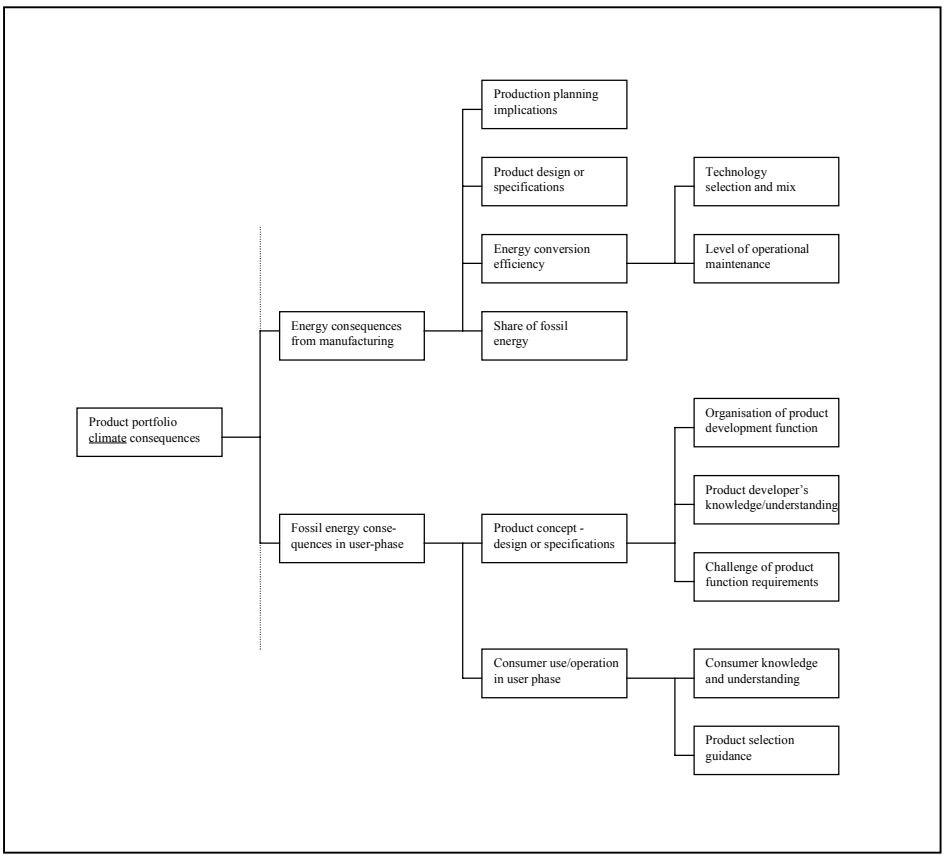


Fig. 3.3: Example of 'causality chain' for climate effects

Priority setting of significant aspects and/or of the individual causes of these should be made by the project group or by using an internal or external expert panel. Alternative methods for impact valuation and priority setting are available. The most frequently used valuation methods being used are the Buwal Eco-Scarcity method, the EPS (Environmental Priority Strategies) method and the Normalisation method. A technique

to define the links between causes for environmental impacts and their environmental effects is shown in App.7.

3.4 Review of strategic decision or communication situations

There may be a number of strategic decision situations that may lead to undesired, environmental consequences in the short, medium or long term. Examples of decision situations may be:

- Business concept decisions related to the type of demands the company is trying to fulfil (e.g. IT-based communication services, manufacturing of selected products or product portfolios etc.)
- Policy decisions (e.g. ambitions regarding climate consequences of products and processes, human health issues, company ethics etc.)
- Functional strategy decisions - either corporate decisions or functional decisions within marketing, manufacturing, procurement, product planning, human resource development or finance (e.g. product portfolio mix, selection of manufacturing technology, direction and ambition of competence improvement etc.)

4a. Review of strategic decision situations and decision-makers' needs of information

The following steps are suggested:

i Identify strategic decision situations with significant potential consequences on sustainability and identify the managers who make them.
Potential decision-makers may be BOD-members, managing director and/or functional managers.

ii Identify strategic decision makers' needs for indicators, tools and data (format, time perspective, sustainability aspects etc.) and frequency of indicator requests.

Depth interviews with the selected decision-makers and analysis of a few strategic decisions already made are suggested as a technique to obtain this information.

4b. Review of relevant communication situations and identification of relevant stakeholder groups

The following steps are suggested:

i Identify a set of external stakeholders and their needs for the environmental aspects focused by this set of stakeholders.
Potential external stakeholders may be financial institutions, insurance companies, authorities, the public, NGOs, media etc.

ii Identify these stakeholders' needs for indicators tools (format, time perspective, sustainability aspects etc.) and frequency of indicator requests.

Questionnaires (cf. the technique described in App.9), reply formats to environmental reports, internet based two-way communication and/or depth interviews with selected stakeholders are suggested as techniques to obtain this information.

3.5 Development of a relevant set of SPIs

Based on the information obtained in steps 3.1 to 3.3, SPIs may then be defined and prioritised according to the relevant cause effect chain of the individual sustainability problems (cf. App.2).

More detailed description of techniques or methodological approaches being used in the NORDEPE-project's case studies are given in App. 1-10.

Note that SPIs may be used to define the sustainability profile of strategically important parts of the product portfolio (cf. App.8), as well as for benchmarking purposes (cf. App.10).

3.6 Implementation and testing of the selected set of SPIs

Testing of the initial set of both types of indicators is intended to reveal:
- how the SPIs have been perceived and understood,
- whether they have been useful for the intended purposes,
- if they have provided the necessary environmental information to the selected decision makers, or which are the organisational requirements to make the indicators work on a continuous basis in the stakeholder organisation

3.6.a Implementation and testing of relevant strategic SPIs into decision processes.

For the strategic indicators, a company internal workshop or meeting with the relevant decision makers is suggested, where the intentions behind the strategic SPIs, the way to implement them, the length of the test period and the responsibility to make them work according to intentions all are discussed and decided.

The SPIs for strategic decisions may be implemented e.g. through a normal company strategy planning cycle and through the budget process.

3.6.b Implementation and testing of relevant SPIs into external reporting and communication processes.

For the external communication indicators a dialogue is initiated with individual stakeholders, where the intentions behind the SPIs, the way to implement them, the length of the test period and the responsibility to make them work according to intentions all are discussed and decided. This dialogue may take place either face-to-face with the relevant person(s) representing a certain stakeholder group or by telephone.

Indicators for external communication will be made available to external stakeholders through annual reports.

To collect results and experience from the testing period, formalised interviews may be used.

3.7 Gathering of experience and subsequent adjustments of the SPIs

Based on the original set of SPIs and experience gathered, a final set of SPIs are defined for use in the relevant decision and communication situations. Note that a set of SPIs may not be defined once and for all, but should be revised according to changing needs from strategic decision makers and external stakeholders or according to changing situations. SPIs may be used both within companies and for external benchmarking.

3.8 Implementation in the organisation

A plan for implementation and modification procedures should be established by the project group.

Full implementation should then be left to internal decision makers (strategic SPIs) and personnel responsible for reporting/communication SPIs (communication SPIs).
Care should be taken during the implementation process so that all future users of the indicators fully understand and acknowledge how and in which situations the indicators should be used.
It may be wise to start out with a limited number of indicators. In this way on can more successfully secure proper use at all relevant organisation levels during the implementation and test period, before a more ambitious number of indicators are introduced in a broad number of decision and planning situations.

SPI-development and implementation should be seen as a learning process, where it is important to gain environmental understanding and build-up of environmental knowledge within the company through working with the development and testing of indicators. In this process, it may be wise to realise that the optimum results from indicator use will not be obtained in the first attempt.

3.9 Reporting

A final project report should be made by each company, to serve as a company-internal reference document in the indicator implementation process.

References

Azzone, G. and Manzini, R. (1994) Measuring Strategic Environmental Performance. *Business Strategy and the Environment*, vol.3, no.1, 1994.

Azzone, G., Noci, G., Manzini, R., Welford, R. and Young, C.W. (1996) Defining Environmental Performance Indicators: An Integrated Framework. *Business Strategy and the Environment*, vol. 5, 1996.

Blanchard, B.S. and Fabrycky, W.J. (1989) *Systems Engineering and Analysis*. Prentice Hall, UK. ISBN 0138807582

Blumberg,J. & al., WBCSD. 1996. Environmental Performance and Shareholder Value. The MIT Press, Massachusets,USA

DeSimone, L., WBCSD. 1997. Eco-efficiency: The business link to Sustainable Development. The MIT Press, Massachusets, USA.

di Norcia, V, Cotton, B. and Dodge, J. (1993) Environmental performance and competitive advantage in Canada's paper industry. *Business Strategy and the Environment*, vol.2, no.4, Winter 1993.

Ditz, D. & Ranganathan, J, WRI. Measuring up: Toward a Common Framework for Tracking Corporate Environmental Performance. WRI, USA.

DoE, UK. 1997. Indicators of Sustainable Development for the United Kingdom. DoE, Norwich,UK.

EEA. 1998. Information for Sustainability: The Role of Eco-Efficiency Indicators. EEA, Copenhagen, Denmark.

European Comission/DG II. 1996. Summary of Establishing Environmental Indicators for the Sustainable Utilization of Raw Mmaterials. EC/DG II, Brussels, Belgium.

European Green Table (1993) Environmental Performance Indicators in Industry.

Fussler,C. & James,P. 1996. Driving Eco-Innovation: A Breakthrough discipline for Innovation and Sustainability. Pitman Publishing, London, UK.

Greener Management International, The Journal of Corporate Environmental Strategy and Practice. Issue 21, Spring 1998. Greenleaf Publishing, 1998.

Hanssen, O.J., Førde, J.S. and Thoresen, J. (1994) *Environmental Indicator and Index Systems*. Research report; Oestfold Research Foundation. Fredrikstad, Norway.

Hardi, P. & Zdan, T. 1997. Assessing Sustainable Development. IISD, Winnipeg, Canada.

Hocking, R.W.D. and Power, S. (1993) Environmental performance: Quality, measurement and improvement. *Business Strategy and the Environment*, vol.2, no.4, Winter 1993.

Holmberg, John, Backcasting – a Natural step when making sustainable development operational for companies, Physical Resource Theory, Chalmers University of Technology and Göteborg University, 412 6, Göteborg, Sweden, Draft, September, 1998.

IISD. 1995. Performance Measurement for Sustainable Development. IISD, Winnipeg, Canada.

ISBN 82-7520-162-4.

ISO/TC 207/SC 4 (2000) *ISO 14031 Environmental management - Environmental performance evaluation - Guidelines.* Draft International Standard ISO/DIS 14031. ANSI 1997.

James, P. (1994) Business environmental performance measurement. *Business Strategy and the Environment*, vol.3, no.2. Summer 1994 .

Lehni, M. (1998*) WBSCD project on eco efficiency metrics and reporting; state-of-play report*. World Business Council for Sustainable Development, Geneva. February 1998.

Lehni, M., WBCSD. 1998. WBCSD Project on Eco-Efficiency Metrics & Reporting. State-of-Play Report.

Liedtke, C. & Kuhndt, M. 1998. Towards a Sustainable Enterprise: An Owerview of the Work in the Sustainable Enterprise Program. Wuppertal Institute, Germany.

Mitchell, G. (1996) Problems and fundamentals of sustainable development indicators. *Sustainable Development*, vol.4, 1996.

Monsanto Sustainability Report (http//www.monsanto.com)

Nordic Council of Ministers (1994) *Nordic Manual on Product Life Cycle Assessment - PLCA*. Copenhagen, 24 - 25 October, 1994.

Report no.3, Draft handbook. ISBN 82-992972-2-2.

Rickman, A. (1995) The role of industry in environmental protection. *Eco-Management and Auditing*,

Smeets, E. & Weterings, E. 1997. Environmental Indicators: Typology and Overview: Paper prepared for EEA. TNO, The Netherlands.

Spangenberg, J. & al. 1997. Material Flow based Indicators in Environmentlal Reporting: A Report for the EEA's Expert's Corner. Wuppertal Institute, Germany.

Spangenberg,J. & Bonniot, O. 1998. Sustainability Indicators: A Compass on the Road Towards Sustainability. Wuppertal Institute. Germany.

Swiss Bank Corporation. 1998. Environmental Rating Questionnaire for the Energy Supply Sector. Environmental Performance Rating. SBC, Base, Switzerland.

TemaNord. 2000. Proposal for a common Nordic IPP. Saltsjøbaden December 2000. TermaNord 2000:505/ISBN 92-893-0415-4.

The New Economics Foundation. 1998. Briefing Paper on Social Auditing. London, UK

Thoresen, J. 1999 Environmental Performance Evaluation – a tool for industrial improvement. *Journal of Cleaner Production* no. 7, 1999

UNCSD. 1996. Indicators of Sustainable Development: Framework and Methodologies. UN, New York, USA.

University of Dundee, The Centre for Social Accounting Research.. 1997. Social & Environmental Accounting. Vol 17, No 2. 1997.

Welford, R. 1993 Breaking the link between quality and the environment. *Business Strategy and the Environment,* Winter 1993.

Wells, R.P., Hochman, M.N., Hochman, D.H. and O'Connell, P.A. (1992) Measuring environmental success. *Total Quality Environmental Management*, Summer 1992.

vol. 2, 1995.

Öko Institut,Institute for Apllied Ecology. 1997. Sustainable Hoechst: Sustainable Development – From Guiding Principles to an Industrial Tool. Werbegrupp & Verlag Roland Netsch,Mühltal,Germany.

Appendix 1

NATIONAL AND INTERNATIONAL SUSTAINABILITY CONCERNS

Resource and ecological effects of industrial products and processes

The sustainability concept introduced by the World Commission on Environment and Development (WCED) in 1987 forms the basis for international efforts in eliminating or reducing environmental effects caused by production processes and product behaviour through the products' life cycles. Although 'sustainability' is not precisely defined, it comprises three key areas of concern:

- Industrial performance should not counteract intergenerational needs for quality of life; i.e. any type of industrial behaviour should not prevent future generations in satisfying their needs.
- Economic growth should be influenced in a way that environmental burdens or impacts from production processes and products do not exceed critical loads on local, trans-national and global recipients (air, water and soil), resources and natural habitats, i.e. the impacts should not exceed limits where the condition of recipients, resources and natural habitats cannot be reversed.
- The reduction of world poverty is essential to reach global sustainability.

The translation of the sustainability concept into international and trans-national environmental focus and action has given the following areas of priority:

- Reduction of resource use (energy, water, land and biotic)
- Exchange of fossil energy resources with renewable resources
- Minimising materials usage – especially non-renewable materials.
- Minimising waste production
- Reducing global climate problems.
- Reversing of ozone layer depletion
- Reduction of local, national and trans-national acidification processes from the atmosphere
- Reduction of build-up of nutrients in rivers and oceans.
- Protection of bio diversity

The selection of SPIs to evaluate and adjust consequences from strategic decisions in corporations or companies may be carried out through an environmental review where environmental impacts from business concepts, policies, products or product portfolios and processes are selected with a basis in the listing above.

Human health effects from production and use of industrial products and services

In the Scandinavian countries the understanding of environmental concerns has been expanded to comprise health and occupational health issues as well. In this project one has chosen to include both occupational health effects on the production site and toxicological and non-toxicological effects on humans off-site, all along the product life cycle.

Economic effects from production and use of industrial products and services

Industrial products and processes may cause large impacts on the environment or on human health. Some costs are appearent, i.e. through taxes or levies connected to environmental impacts from effluents, emissions, resource use or disposal. In other cases, the socio-economic cost of remediation of harmful environmental impacts cannot be calculated with a reasonable degree of scientific accuracy. Under such circumstances, taxes, levies or different types of incentives may in the future be introduced by politicians to force the polluter to pay their share for e.g. the societal remediation of respiratory problems in general, caused by emissions from fossil fuel combustion gases.

The risk of political demands for internalisation of such costs into corporate book-keeping is quite possible, and therefore indicators may be used to show the degree of exposure to such future demands on corporate cost accounts.

Corporate social responsibility effects from production and use of industrial products and services

Corporate social responsibility comprises the well being of both a company's own employees and business associates, but also the responsibility for the general public who may be harmfully affected by the production or use of products originating from the company in question.

In this project, one has chosen to define corporate social responsibility according to the proposal from the Global Reporting Initiative (GRI, 2000). In this context, corporate ethics should be one perspective, which is included, when corporations make their short and long-term decisions according to the listing of potential social responsibility effects.

Based on the sustainability concerns expressed above, a more operational and comprehensive listing has been developed in the following table:

Table A.1: Categories and sub-categories for significant sustainability aspects

Sustainability indicator categories and sub-categories		
Effects on resources	**Ecological effects**	**Human health effects**
Depletion of energy Resources	Climate effects	Occupational health effects
Depletion of material resources (in particular non-renewables)	Depletion of stratospheric ozone	Toxicological effects off-site
Depletion of water resources	Acidification	Non-toxicological effects off-site
Depletion of land resources	Eutrophication	
Depletion of biotic resources	Photo oxidant formation	
	Eco toxicological effects	
	Habitat alterations and effects biological diversity	
Social responsibility effects	**Economic effects**	
Quality of management	Appearent cost of effluents, emissions, resource use and disposal	
Wages and benefits	Social cost of effluents, emissions, resource use and disposal	
Non-discrimination	Donations	
Training and education		
Child labour		
Forced labour		
Freedom of association		
Human rights		
Social performance of suppliers		
Social impacts from products and services		

Appendix 2

SELECTION OF DECISION ISSUES FOR SPIs

Medium to long term profits should be the basis for environmental indicators used in strategy decisions (Kaplan and Norton, 1996). This is verified by a Scandinavian survey (POMSnord, 1999) recently carried out by Stiftelsen Østfoldforskning, COWI and Econ Analyse. The focus should then be to define which strategic decisions have an important bearing on environmental impacts from products and processes, and how these decisions should be supported by means of strategic, environmental indicators.

A causality chain is shown below, to expand our understanding of the multitude of links between profits (desired end effect) and key areas of influence (interlinked causes).

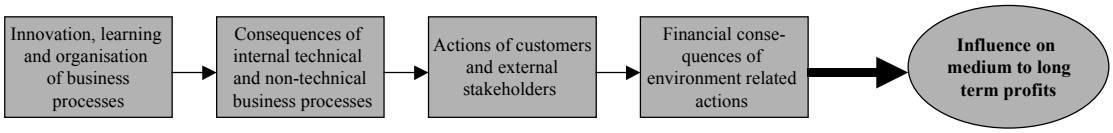


Fig. A.2.1: Balanced score card model of environmental performance /Kaplan and Norton, 1996/

This figure clearly shows the necessity of establishing causality chains for essential, sustainability impacts and defining strategic SPIs for the most important causes of the impacts one wants to avoid. Then these SPIs should be implemented in the relevant decisions situations.

An example of a causality chain is given in fig. A.2.2 below, where the individual causes of climate consequences are shown.

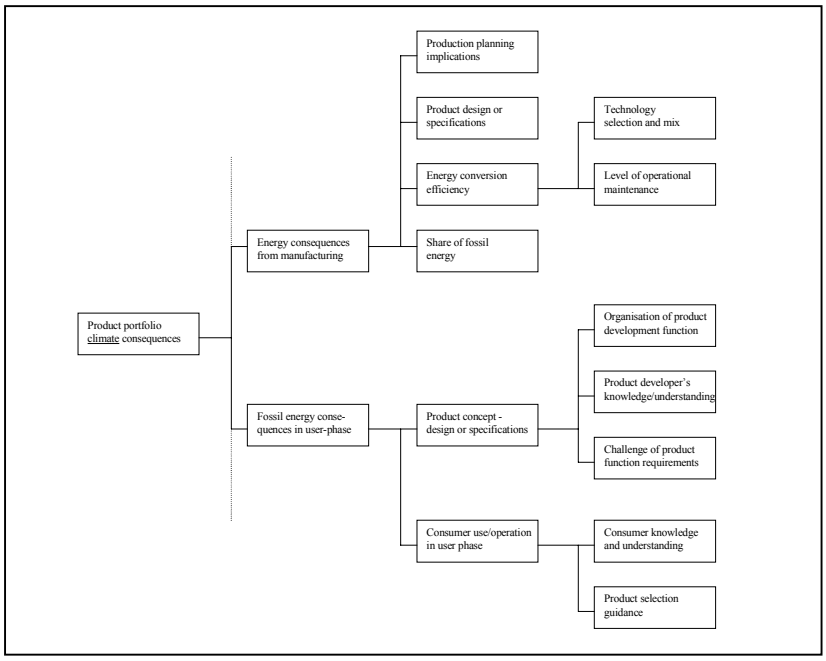


Fig. A.2.2: Example of causality chain

Once the causality chain has been defined, one must select high-priority issues along the chain to be followed up by the development and implementation of relevant, strategic EPIs.

Appendix 3

INTRODUCTION TO THE BACKCASTING TECHNIQUE

1. Why use the backcasting technique

Backcasting is "the opposite" of forecasting. As the opposite of how the meteorologist works, the backcasting implies a jump into the future to envision the future situation. This future should not be drawn up based on today's situation, but based on scenarios.

By starting out from the sustainable situation instead of today's situation, the risk of limitation in the development of strategies based on today's limitations may be avoided. The backcasting technique will also be easier to interpret than a forecasting technique when looking ten years or more into the future, since the given future sustainable situation/ scenario has to be chosen and presented. In that way the given assumptions are transparent. Many different scenarios for the future have been published an many of these describe in some way a sustainable development or sustainable scenario. The parameters in these scenarios often include e.g. world population and total consumption of energy wares. Other parameters involve parameters related to relations between east and west and north and south as well as level of technology and world trade (see table A.3.1).

The backcasting technique (or a combination of forecasting and backcasting) is often used in strategic planning for large companies when deciding future investments and larger planning and marketing strategies. The technique has the advantage that it is clearly declared what future scenario seems to be most likely, and then which development and strategy that has been chosen based on that certain scenario. If the real situation changes into a different direction compared to the selected scenario, the strategy can be changed in line with the actual or forecasted situation. According to Dreborg (1996) the backcasting technique is particularly useful when the problem studied is complex, dominant trends are part of the problem, there is a need for major change and the scope is wide enough and the time horizon is long enough to leave considerable room for deliberate choice.

Holmberg (1998) has described the backcasting technique for strategic planning towards a sustainable development in some Swedish large companies. Below, the backcasting technique is described based on Holmberg (1998), as well as how it can be used for this project.

2. Description of the backcasting technique used for sustainable development

The steps of the backcasting technique and strategic planning towards sustainability are presented in fig. A.3.1.

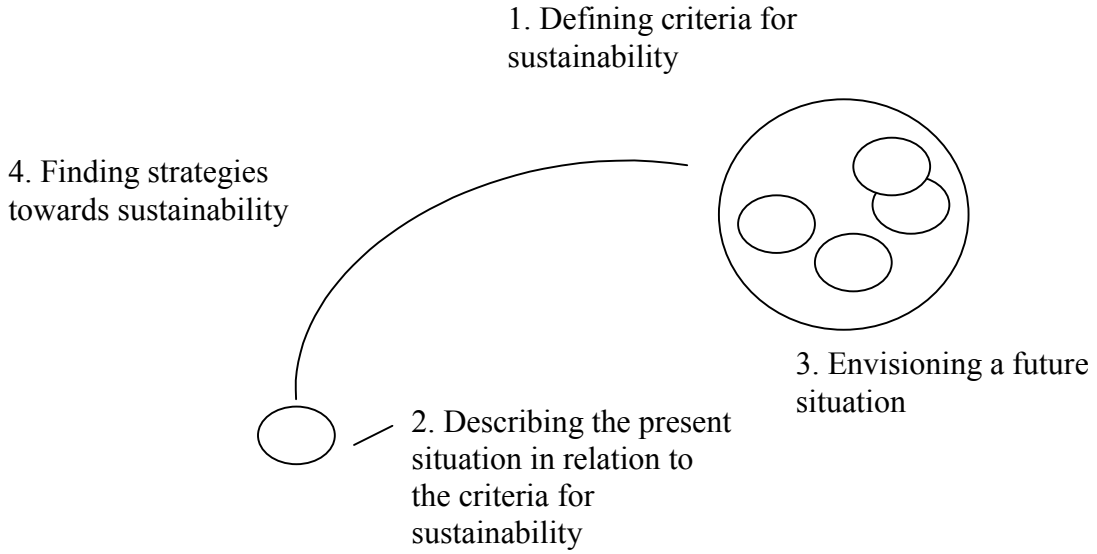


Fig. A.3.1 : The steps in backcasting used for strategic planning towards sustainability (Holmberg, 1998).

Step 1. Defining criteria for sustainability

In Holmberg (1998) the four socio-ecological principles for sustainability are used. These are four non-overlapping criteria for how human beings should interact with nature in a sustainable and fair way. The criteria are the following: in order for a society to be sustainable, nature's functions and diversity are not systematically:

- subject to increasing concentrations of substances extracted from the earth's crust
- subject to increasing concentrations of substances produced by society
- impoverished by over-harvesting or other forms of ecosystem manipulation and
- resources are used fairly and efficiently in order to meet basic human needs world wide

In this project these principles may be used as a basis, but should be exemplified and be given in more detail also in relation to the geographical and time frames that the specific companies work with.

If for example the actual product is a turbine for hydropower, it is important to put up criteria for land use, change of water flows, etc. These aspects are perhaps the most important (together with change of air pollution as an alternative electricity source) for that product.

Step 2. Describing the present situation in relation to the criteria for sustainability

The present activities and specific competence of the company is analysed in relation to the sustainability criteria. If the four above-mentioned principles are used, today's

activities, products, etc are checked in order to identify whether or not they are in accordance with the principles.

At the same time it may be useful (even though not easy) to question whether the business concept of the company today will be the same or change focus in the sustainable situation (instead of "selling hamburgers" the concept may be "fast and nutritious food at a low prices").

In this study, e.g. results from LCAs or supplier surveys can be used to identify environmental aspects in conflict with the principles.

Step 3. Envisioning a future situation

In the future situation shown I fig. A.3.1 the restrictions and the possibilities that the sustainability criteria required are discussed. The role of the company/business unit/product in the future sustainable situation can be discussed. The following questions can be asked:

What service/utility is delivered?
What human needs are fulfilled?
Can the competence be used to fulfil other human needs or functions in a sustainable society?
Will new production sites be established? Where can the new production sites be established in order to be in line with the sustainability criteria?
Which new markets have been identified and are they in line with the sustainability criteria?

Step 4. Finding strategies towards sustainability

The strategies that link the sustainable scenario to today's situation are identified. A "solution" to the possibilities and problems identified in the steps above are identified as possible strategies. The relevant and probable decisions that will be made in the future can be identified (as exemplified above), and the possible solutions for those decisions that are sustainable can be identified. The investment decisions that will be taken and the changes in design that will be made should be evaluated in relation to the sustainability criteria. For example the strategies needed for a company within the transportation sector may deal with starting out from using today's fossil fuels and ending at transportation where emissions of greenhouse gases are decreased to a minimum level.

Based on the future situation envisaged in step 3, a mid term position may be identified in order to have an "in-between" stage, which does not seem too far away, but is still not only based on forecasting today's situation.

Table A.3.1 : Parameters chosen as variables for the Swedish study Sweden 2021.

Real global economical growth
World trade
Swedish export
Technical development

Population
Population rate
East-west relations
North-south relations
Dominant valuation

Energy use
Energy prices
Energy technology/intensity
Dominating energy ware

Global forest areas
Global available energy wares
Global water resources
Land available
Emissions of greenhouse gases
Ecological co-operation

Appendix 4

BACKCASTING OF THE FUTURE WITH THE AID OF TECHNOLOGY SCENARIOS - Methodological approach used in the UPM Kymmene Case Study

The methodological approach used in the UPM Kymmene Case Study is illustrated in Fig. A.4.1.

Step 1 - a framework for sustainability is defined from the company's perspective.

Policies and principles that presently steer and affect the company's business operation and more general principles that will guide the transition towards sustainability were defined. The four main SD principles defined by the Natural Step Foundation /K.H. Robert, 1997/ were also relied upon:

- Limitation of increased concentrations of substances extracted from the earth's crust
- Limitation of increased concentrations of substances produced by society
- The ecosystem should not be impoverished by over-harvesting or other forms of manipulation
- Resources must be used fairly and efficiently in order to meet basic human needs world-wide

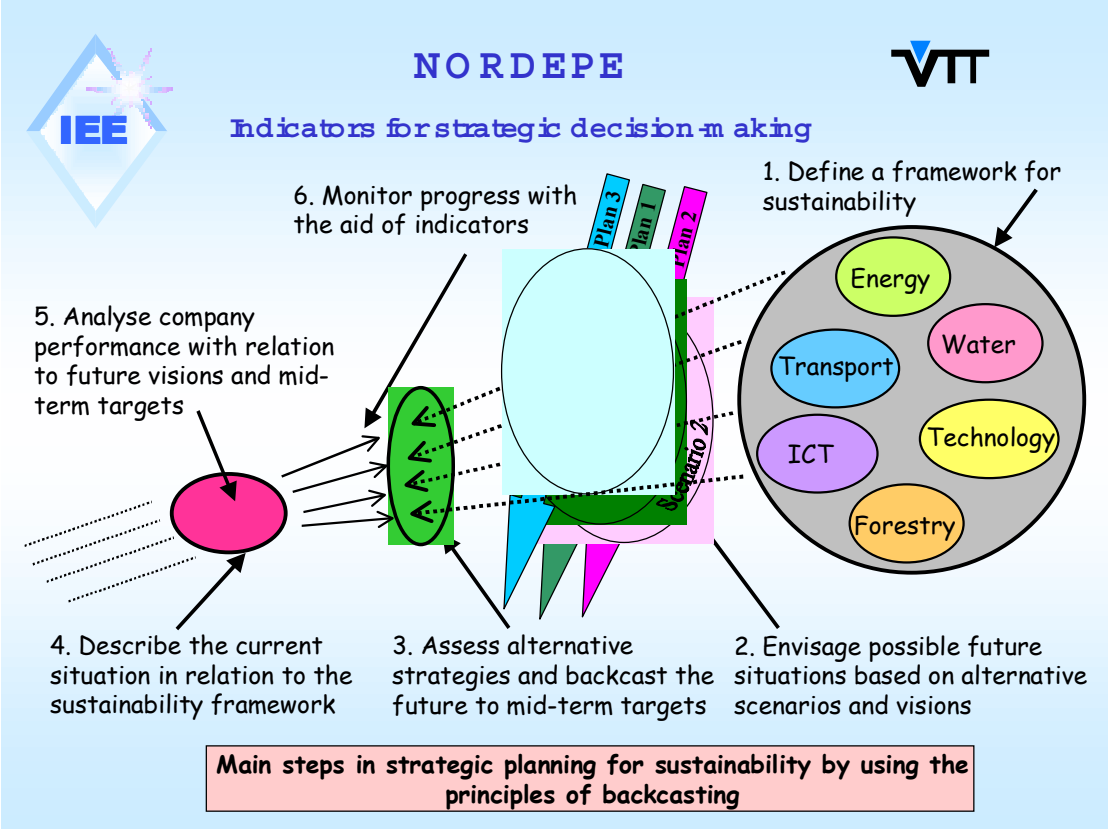


Figure A.4.1: Main steps in the backcasting method

Step 2 - Different future scenarios and the main drivers for change in each scenario is identified. The chosen scenarios were:

IV. *Big is Beautiful*
V. *Knowledge is King, and*
VI. *Creeping Change*

These scenarios that stretch up to year 2050 were borrowed from the Dutch "Visions" Project /ICIS, 1999/ and then analysed from the forest industry perspective.

The first scenario *"Big is Beautiful"* is mainly capital driven, the second one *"Knowledge is King"* is based on the assumption that the rapid developments in information and communication technology will dominate the scene, and in the third scenario, *"Creeping Change",* environmental and socio-economic issues are steering the change.

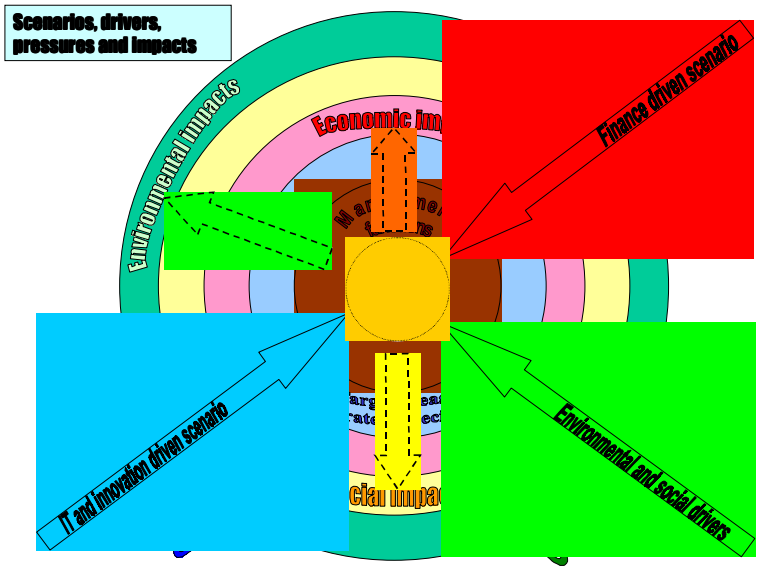


Figure A.4.2: Backcasting of future scenarios to strategic decision-making situations

Step 3 - these more general scenarios and the main drivers behind them is assessed in more detail by backcasting them to sub-area visions closer to the present situation of UPM Kymmene, and in the light of the company's alternative strategies for the future. The following six different areas of strategic decision-making were assessed separately:

1) Location of operations and raw-material supply
2) Process technology and environmental issues
3) Energy supply and transportation
4) Product portfolio and marketing
5) Organisation and personnel
6) Research and development, and other business interests

Step 4 - possible economic, environmental and social impacts of alternative strategies were assessed with the aid of indicators. Drivers and possible rebound effects being assessed were i.e. population growth, political changes, legislation, economic globalisation, climate change, resource utilisation, water availability, technology developments, de-materialisation, miniaturisation, biodiversity, ecotoxicity, genetic engineering, developments in ICT, transportation systems, emission trading, market liberalisation, and social dimensions on a global level.

The three different scenarios were compared, and indicators of significance and indicators of less relevance were identified for each scenario. As benchmarking indicators were those suggested by Global Reporting Initiative/GRI, 2000/ used.

Company internal experts and representatives of different stakeholder groups were used for the assessment. Persons approached were also asked to give their personal views on the different scenarios and to comment on the selection/disregarding of certain indicators.

Finally the panelists were asked to do a subjective SWOT-analysis of each scenario by commenting on strengths (S), weaknesses (W), opportunities (O) and threats (T) linked to a certain strategic decision area. A relative rating scale from 1 to 3 was also used. The final SWOT result will thus be an aggregated and multidimensional matrix of indicators expressed in qualitative terms or as relative indices, e.g. "very strong-rather strong-weak" or "extremely risky-might work-just go ahead".

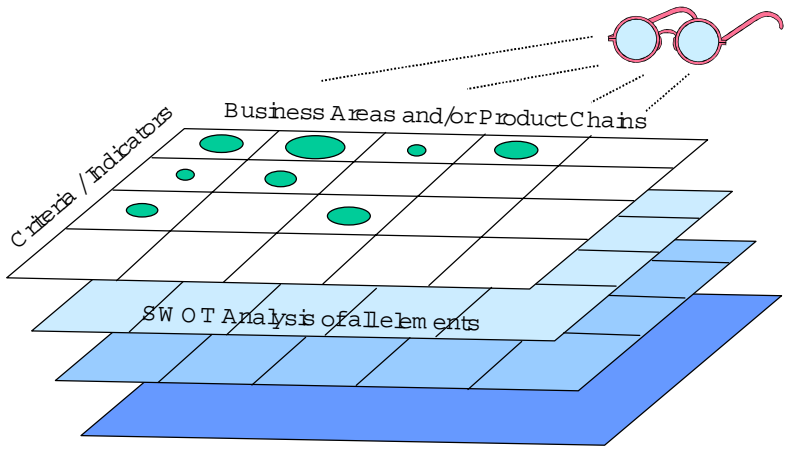


Figure A.4.3: Assessment of strategic decisions with the aid of an indicator based SWOT-matrix

Indicators found to be very significant should be used as road signs, when defining new strategies, and when monitoring company performance and the progress towards sustainability.

Step 5 - information regarding the current performance, procedures and practices is collected. Data on resource utilisation, processes, product portfolio, management systems, decision-making practices, R&D-activities, asset management, competence building, marketing and information procedures within the organisation, and the services/utilities that are produced were analysed in the light of chosen future scenarios and challenges, and were similarly benchmarked against the GRI indicators.

Step 6 - strategies that link the current situation with the future sustainable situation are identified. In other words, strategies, road signs or indicators to be followed by the

company will be defined. The indicators should be integrated into the management system, operationalised, and result in a final roadmap.

Appendix 5

BACKCASTING OF THE FUTURE DESCRIBED BY THE NATURAL STEP FRAMEWORK - Methodological approach used in the FORTUM P&H Case Study:

The methodological approach used in the FORTUM P&H case study and the differences and interconnections of the two separate parts of the study are illustrated in Fig. A.5.1.

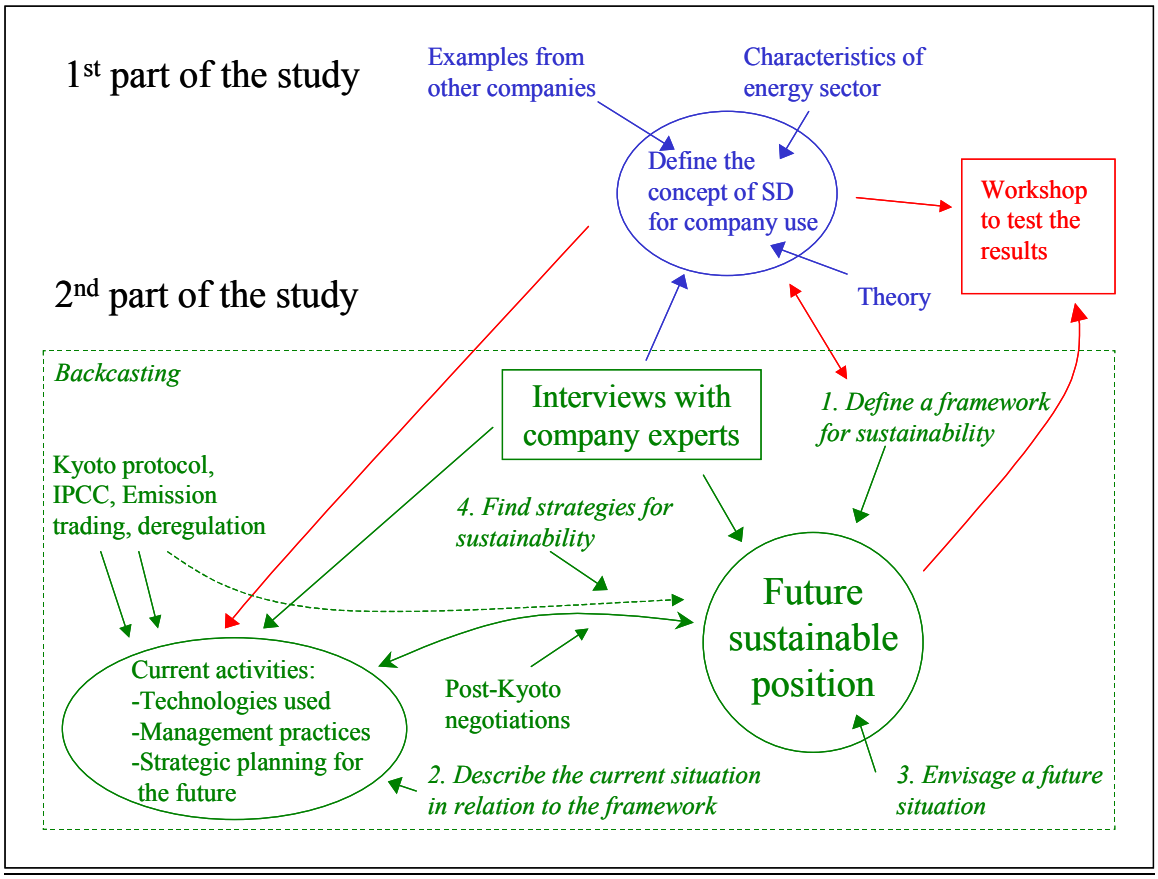


Figure A.5.1: The research methodology used in the FORTUM P&H Case Study.

Methodologically the study was based on experimental action research, that is, learning about social systems by trying to change them. Action research has been defined as research that aims to contribute both to the problem solving and to generate new scientific knowledge.

The main objective of the study was to answer the question: *"What options does a modern energy company have for the development of strategies for sustainability?"*

The first part of the study thus focused on defining sustainable development from the company's perspective and the second part on backcasting the framework of SD to strategies for sustainability. The contribution to the problem solving in this work came through the sustainable strategies generated by using the backcasting method and from the analysis of the respondent opinions about SD. The scientific contribution was the

analysis of different backcasting methods and how these fit into the overall framework for corporate sustainability.

Analysis of company perspectives on Sustainable Development

The primary data for the part assessing a corporate approach towards SD was collected through personal interviews. As a start some unstructured interviews were conducted with key personnel of the company. The objective was to find out the current position of the company in relation to SD and to prepare the questions for the more structured interviews to be conducted later on.

Based on the unstructured interviews and conceptual framework, a set of open questions was prepared for the structured interviews. The interviews addressed the following topics:

- Definitions of SD
- Usefulness of the concept of SD for corporate purposes
- Areas of business operations where SD would be most useful for the company
- The role of stakeholders in the SD process
- Main barriers to the involvement of stakeholders in the SD process
- Main advantages of involving stakeholders in the SD process
- Priorities in the corporate approach to SD

The set of questions was constructed in such a way that it had both direct questions about SD (e.g. how would you define SD?) and triggering questions for further discussions. Some questions about the corporate communication and stakeholder dialogue were addressed to identify areas where these should be reinforced and also to identify the areas where stakeholders see that the company is acting properly.

The internal respondents represented different activities of the company. The external people interviewed were representatives of the major stakeholder groups of the company (media, owners, major customers and NGOs). For the purpose of maximising the outcome of the stakeholder interviews, suitable stakeholder representative/company representative pairs (e.g. a major industrial customer/the person responsible for industrial customers) were considered when selecting the people. Results of the interviews with the internal people were analysed anonymously, to identify areas where the corporate approach to SD should be reinforced or reviewed. The possible misunderstandings and different interpretations inside the company were also identified. The interviews with the main stakeholder group representatives were used to identify areas where the ideas of the company about SD differed from the ones of the stakeholders.

The secondary data originated from various literature sources in the areas of SD and corporate environmental management. The literature sources were selected keeping in mind results of the analysis of the primary interviews. For the purpose of making the work useful for the company, the already established commitments of the company were prioritised.

Application of Backcasting

The application of the backcasting principles for the corporate strategic planning process was conducted in the form of two half-day workshops. The primary aim of the first workshop was to introduce the method to be used to the participants. The aim of the second workshop was to obtain useful results for the company, after the method had been developed further, using the experiences gained in the first workshop.

The primary data for the backcasting part of the study was collected in unstructured interviews, a questionnaire directed to the participants of the workshops, and by observing the participants during the workshops. The unstructured interviews before the workshop were used to develop the method used during the workshop. Additional comments from the participants were also collected in interviews after the workshops.

The secondary data consisted of literature sources of backcasting, strategic planning, scenario planning, and scenarios of the future. The reason for conducting the study in the form of workshops was because neither the project group nor the participants had previous experience of the utilisation of backcasting. In this way it was also possible to engage more people in the method development process.

The Natural Step (TNS) Framework

The Natural Step organisation together with the Chalmers University of Technology has developed a framework for corporate sustainability, the TNS framework. The TNS framework is based on the idea that even if it is not possible to describe the sustainable future in detail, it is possible to define its basic principles. The TNS framework consists of two elements, first of all the system conditions describing the framework for future sustainable situation, secondly a backcasting approach to develop strategies towards sustainability. These two elements are divided in four different steps (A to D). According to Robèrt (2000) the TNS framework is used for dialogue, problem solving, and strategic planning, and as a guiding framework for other environmental management tools, like Environmental Management Systems (EMS). The four steps of the framework are:

(A) share and discuss the model;
(B) analyse present activities, the critical flows with reference to system conditions, and relevant metrics to monitor the phase out of those critical flows;
(C) envision tomorrow, and list the possibilities for providing the same services without violating the system conditions and;
(D) design the program for transition.

According to the Natural Step, the future sustainable society is based on four non-overlapping principles (step A), which state that in order for society to be sustainable, nature's functions and diversity must not be systematically:

1. subject to increasing concentrations of substances extracted from the earth's crust;
2. subject to increasing concentrations of substances produced by the society;
3. impoverished by over-harvesting or other forms of ecosystem manipulation; and
4. resources should be used fairly and efficiently in order to meet the basic human needs world-wide (Holmberg, 1998).

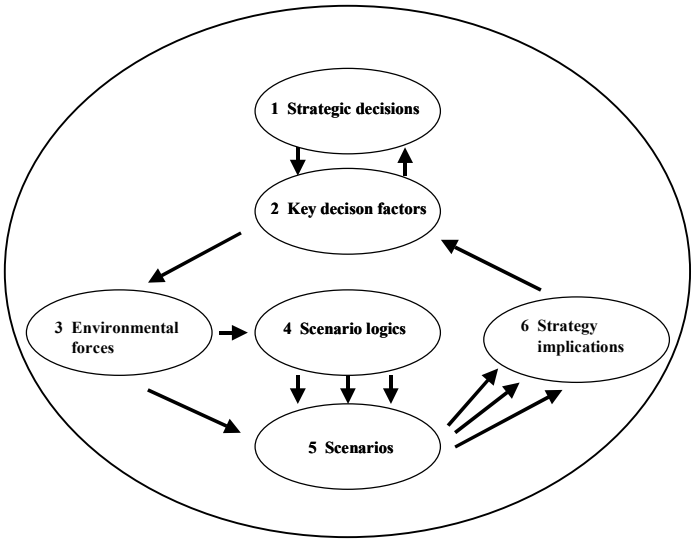
Furthermore, these criteria supplied with additional explanations and interpretations should cover all areas of sustainability. The evaluation of the current state of company operations in relation to the criteria in step B gives a good picture about the challenges of the company towards SD process.

Appendix 6

THE FORECASTING SCENARIO TECHNIQUE – applied to define essential sustainability aspects

Theoretical basis

The method is based the SRI scenario method (ref. Ringland, 1998).



Step 1 – strategic decisions

Which types of decisions influence corporate sustainability profile?

Examples – types of strategic decisions:
- Product design/specifications?
- Technology selection?
- Supplier selection?
- Product portforlio selection?

Step 2 – Key decision factors

Definition of drivers, barriers or uncertain trends.

Examples – Key decision factors:
- Authorities' requirements?
- Market conditions?
- Own competitive edges?
- Competitive trends?
- Critical resource availability?
- Future environmental challenges?

Step 3 – Environmental forces

Analysis of strength, direction and probability for Key decision factors .

Examples – environmental forces:

- Political climate gas requirements – 30% national reduction requirements within 2012. High probability.
- Radically higher requirements 2012-2020. Medium level probability.

Step 4 – Scenario logics

What will be linkages and logics that combine these Environmental forces?

Examples – scenario logics:
Links between climate gases, authorities' requirements, competitors' actions and consumer(customer reactions.

Step 5 – Scenarios

Defining development scenarios based on knowledge and understanding gained from steps 1-4, which will have bearing on company strategies, products and processes.

Examples - scenarios:
Based on different views of how national and international political sustainability requirements and control instruments will influence markets, product acceptance and technology options etc.

Step 6 – Strategy implications

Essential, internal analyses and clarification of strategic options and their consequences for the different functional areas of the company.

Leading to:

- Which environmental challenges, with what strength and direction.
- Business strategies based on management's judgement of these challenges.

DEFINITION AND PRIORITY SETTING FOR SUSTAINABILITY INDICATORS

1 Starting point

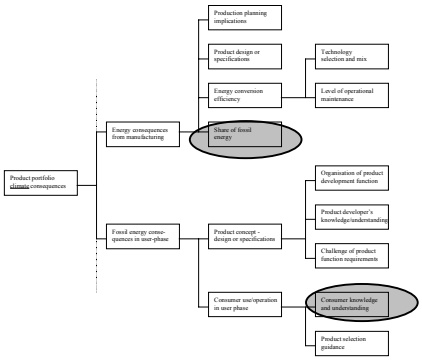
Definition of sustainability aspects obtained from use of the Forecasting scenario technique.

Examples – sustainability aspects:
- Climate effects
- Materials efficiency
- Energy efficiency
- Landscape impacts

2 Cause/effect presentation and priority setting of sustainable performance

A cause/effect is drawn for company activities with impact on the sustainability aspects developed in step 1 above.

Priority setting of the most important causes behind sustainable performance may be defined by using an LCA or by using an external and/or company internal expert group (see shaded activities in the cause/effect diagram on the right).



3 Defining decision situations with relevant to selected causes

Such decision situations are defined by the project group and a dialogue with the relevant decision makers is started, to discuss a future use of the indicators for planning and follow-up.

Examples – decision situations :
- Product portfolio selection
- Product development
- Technology selection
- Competence development
- Technical and administrative, operational decisions

4 Development of relevant strategic indicators

The actual indicators are developed by the project group in co-operation with future users and sanctioned by the project steering committee

5 Implementation of indicator use in the organisation

A thorough information and dialogue with future users (functional decision makers, top management etc.) concerned with potentials and possible problems is desirable before implementation.

6 Testing and adjustment of indicators and indicator use

Practical use of the indicators in the organisation for planning and follow-up purposes may require some adjustments of the original indicators and decision situations for which they were originally proposed. A test period is therefore needed to sort out possible problems, before full introduction of indicator use in the company.

STRATEGISKE MILJØINDIKATORER FOR "AS BEDRIFT" -
A. for generell beskrivelse av miljøambisjoner i ledelsessystemet

Indikator	Hensikt med indikatoren	Relevant for	Bruks-situasjoner	Brukere
EMS% i "as Bedrift" % EMS% leverandører % Nivå på miljøkompetanse %	Styre beslutninger og oppfølging mot en stadig større andel ISO 14.001 (EMAS) sertifiserte fabrikker innen konsernet. Indikatoren er definert som - *Salgsvolum i NOK fra fabrikker med ISO 14.001 sertifikat : samlet salgsvolum i NOK* Styre beslutninger og oppfølging i konsernet mot en stadig større andel ISO 14.001 (EMAS) sertifiserte leverandører. Indikatoren er definert som - *Innkjøpsvolum i NOK fra ISO 14.001 sertifiserte leverandører : samlet innkjøpsvolum i NOK* Styre oppbygging av miljøkompetanse hos nøkkelpersonell innen konsernet. Indikatoren er definert som - *Antall nøkkelpersoner som har gjennomgått grunnleggende miljøkurs x 100 : samlet antall aktuelle nøkkelpersoner med behov for miljøopplæring*	Konsern-ledelse Konsern-ledelse Funksjons-ledelse Konsern-ledelse Funksjons-ledelse	Strategiplan-legging/ oppfølging Strategiplan-legging/ oppfølging Kontraktsin n-gåelse Strategiplan-legging/ oppfølging Budsjettpla n-legging Kursplan-legging/ gjennomføri ng	1 toppledelse 2 fabrikkledelse 1 toppledelse 2 innkjøpsledelse 3 fabrikkledelse 1 toppledelse 2 personalledelse 3 funksjonsledelse

Example:

Aggregate volume of climate gases from the whole corporation :
Indexed, aggregate net income, i.e.

Kg CO2 equivalents : NOK

Appendix 8

DEFINITION OF SUSTAINABILITY PROFILE INDICATORS FOR STRATEGICALLY IMPORTANT PRODUCTS – based on input from the Forecasting scenario technique

1 Starting point

Definition of sustainability aspects obtained from use of the Forecasting scenario technique.

Examples – sustainability aspects :
- Climate effects
- Materials efficiency
- Energy efficiency
- Landscape impacts

2 Sustainability characteristics of products and processes

Sustainability characteristics describing different elements of the product portfolio suggested by the project group and confirmed through some stakeholder interviews. Relevant stakeholder groups defined by the project group.

Examples – sustainability characteristics :
The performance of products and processes are defined by a set of characteristics for each sustainability aspects (see step 1), e.g. for climate effects:
-
-

Examples – stakeholder group selection within the building sector :
- Distributor chains for building materials
- Contractors
- Architects
- Homeowners
- etc.

3 Priority setting of sustainability characteristics

Questionnaires sent out to representatives for selected stakeholder groups asking for priority setting between characteristics.

4 Evaluation of product lines

Project group definition of quantified levels of environmental performance to be described as Poor, Medium and Good performance for each sustainability characteristic.

Then evaluating the selected product line according to these definitions.

KRITERIEBEDØMMING FOR "XX" PRODUKTOMRÅDE

Type kriterium	Miljø-gradering	Lav miljø-profil (L = 1)	Middels miljø-profil (M = 2)	Høy miljø-profil (H = 3)	Profil-bedømming 1995	Profil-bedømming 1998	MP 1995	MP 1998
Produksjon - grad av råvarebruk								
- grad av akkumulert energibruk								
- bruk av fornybar energi (bio/avfall)								
- etc.								
- etc.								
- etc.								
- etc.								
Bygging/ anlegg - transportkonsekvenser								
- etc.								
-								
Bruk - etc.								
- etc.								
- etc.								
Avfall - gjenbrukbart materiale								
- enkel fjerning etter bruk								
AKKUMULERT MILJØGRADERING								
NORMALISERT MILJØGRADERING								

5 Indexing the selected product line

Aggregating the sustainable performance by aggregating stakeholder weighting of each characteristic with project group evaluation into Poor, Medium and Good performance.

6 Developing a sustainability matrix

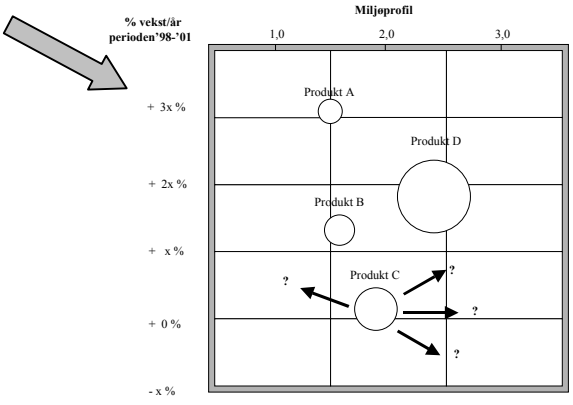
Each productline entered into a sustainability matrix according to its sustainability performance (horizontal axis) and expected market potential (in money value). Current sales volume is represented by the size of the circles defining the position in the matrix of each product line.

On the basis of this matrix, different strategies for development of sustainability- and sales volumes may be decided.

7 Developing sustainability SPIs for selected product lines

The aggregated sustainability performance index for each productline may then be defined according to step 5 above.

These SPIs may then be used for strategic planning, budgeting and follow-up by top management.



PRODUKTORIENTERTE MILJØSTRATEGIER

Appendix 9

STAKEHOLDER ASSESSMENT

This describes a six-step method for carrying out a stakeholder assessment.

1. **Define the purpose of the stakeholder assessment**
- basis for improved communication with stakeholders
- basis for a better selection and priority of environmental actions plans and investments

2. **Identify and classify relevant stakeholder groups**
- identify stakeholder categories
- segregate the stakeholder into defined sub-categories

3. **Define the type of assessment**
- Closed process by testing predefined hypothesis
- Open process by asking for stakeholder opinions
- Criteria for conduction a representative assessment

4. **Selection of method of the assessment**
- sending questionnaires to larger groups
- discussion by focus groups
- interviews of selected representatives
- interviews of expert panels
- systematise internal knowledge
- systematise information from media

5. **Evaluation and analysis**
- Evaluation of representativeness of the different stakeholder groups
- Analysis of results (Factor analysis, analysis of correlation between respondents)

6. **Conclusions**
- what type of information is important to provide the different stakeholder groups
- prioritisation of actions on the basis of the assessment
- what type of information is important to different stakeholder groups
- plans for further communication

Examples

Stakeholder categories

Examples of Stakeholder categories	Stakeholder sub-categories
Neighbours	Age groups, residence-time in the area, education, hobbies and interests, political opinion
Customers	Age groups, income, level of education, hobbies
Employees	Age groups, type of work, type of education,
Owners	Type of owner, amount of ownership
Authorities	type of responsibility
NGOs	Type of organisation

Method selection

Stakeholder Selection	Possible methods
Neighbours	Questionnaires, focus groups with selected representatives.
Customers	Questionnaires, interviews with selected groups, focus groups.
Employees	Focus groups, questionnaires, interviews with club leaders.
Owners	Interviews of selected representatives.
Authorities	Interviews, expert groups
NGOs	Interviews, expert groups

Factor analysis

Gives a statistical independent grouping of different issues – reduces the number of relevant parameters in the analysis.

Issues	Type of stakeholder groups
Positive to the issue	Young customers with high income, major owners, long resident neighbours
Negative to the issue	Customers over 40 years old, neighbours with short resident time, low income

Appendix 10

BENCHMARKING OF ENVIRONMENTAL MANAGEMENT PERFORMANCE -

Methodological approaches used in the SYDKRAFT case study:

The objective of the case study performed at SYDKRAFT was to:
a) Develop a system to evaluate the environmental management performance of the company;
b) Investigate the practicability of the proposed EMPE system;
c) Investigate the usefulness of the EMPE system in facilitating internal benchmarking.

The EMPE system to be developed should serve the following purposes:
- to evaluate the environmental management performance through assessing the progress of EMS implementation in each subsidiary within Sydkraft;
- to identify performance gaps among subsidiaries;
- to recognise good environmental management practices;
- to identify areas for improvement;
- to identify resource requirements, and
- to promote communication and feedback between the parent company and subsidiaries, as well as with the top management.

The tasks involved in the study included the following steps as described below:

Literature review

The first stage of the study involved reviewing literature in order to obtain better understanding in the following areas:
- Performance measurement systems in general
- Performance evaluation methods
- Environmental performance evaluation (EPE)
- Benchmarking theory and practices
- Benchmarking in environmental management
- ISO14000 Series

The company's environmental reports, previous gap audit reports for different sites, and other related documents were also reviewed in order to facilitate the selection of subsidiaries for pilot testing of the proposed EMPE.

Establishment of an EMPE System

As an initial attempt eight environmental management priorities were selected. The selection of these priorities was based upon the EMS requirements as stipulated under the ISO 14001 Standard. Although the priorities were limited in number, they were carefully selected in order to reflect the significance particularly for the implementation phase. Also they should fit in to the continuous improvement model of the ISO 14001 Standard. For each priority, the associated aspects to be evaluated were defined. Based upon the selected priorities and defined aspects to be evaluated, a questionnaire was developed to serve as an information gathering tool, and to

facilitate the subsequent environmental management performance evaluation and the development of management performance indicators (MPIs).

The EMPE system was developed based on the literature review of several quality awards, e.g. the Malcolm Baldridge National Quality Award (MBNQA), the Swedish Quality Award by the Swedish Institute for Quality (SIQ) and the Excellence Model by the European Foundation for Quality Management (EFQM).

Design of a Questionnaire and a Rating System

The questionnaire was organised into four parts as follows:

- Part 1 consists of general information about the company's profile and the respondents' position and responsibilities in relation to EMS implementation in the company.
- Prior to answering the questions in Part 2, the respondents are invited to give weights to the selected eight priorities, which will sum up to 100 points. The assigned weights will then be sub-divided according the importance of the aspects to be evaluated. Upon assigning the weight, the respondents will proceed to the next step - answering the questions for each selected priority.
- Part 3 is self-assessment. Upon answering the questions in Part 2, the respondents are required to self-assess the progress of EMS implementation in their respective company. The self-assessment is based on five defined ratings. A record sheet is provided at the end of this part to record the ratings given by respondents. Sub-total of each priority is then calculated and the analysis of the results will be discussed.
- The fourth part consists of feedback on the questionnaire. Respondents are invited to provide honest and sincere feedback on the comprehensiveness and applicability of the questionnaire. This feedback will be used in the review process. Constructive feedback from the respondents is vital for the improvement of the questionnaire as well as the overall EPME.

Both multiple choice and open-ended questions are used in the questionnaire. For open-ended questions, the "others" option is always provided in order to give flexibility to the respondents in answering the questions. Questions with only "Yes" or "No" answers are avoided as far as possible, instead the "In progress" option is added to better capture the true situation in the subsidiaries.

Design of a Screening Tool for Selection of Indicators

A set of MPIs was developed using an indicator work sheet. In order to ensure the appropriateness of the potential indicators, a screening tool was developed to facilitate the selection process.

While in theory each indicator provides different information and could be used in combination with others it may not be practical to apply all indicators. Hence it is crucial to concentrate on indicators that are most relevant and provide most useful information for decision-making. Focusing on a handful of strategic measures is much more important than ending up in a sea of detailed measures. For this reason, a screening tool was proposed to assess the adequacy and to aid the selection of the appropriate indicators. Screening out the sub-optimise indicators also helps to avoid disproportionate effort and cost being expended in gathering data that only can be

used for specific indicators as well as to maximise the use of existing data or information.

The screening tool was based on the following three guiding principles:
- Principle 1: *Must align with the company's environmental policy and business activities.*
- Principle 2: *Must fulfil EMS requirements.*
- Principle 3: *The set of indicators should include both leading[3] and lagging indicators[4].*

The screening tool consists of both *content* and *quality* aspects that need to be considered when assessing and selecting the appropriate MPIs.

If two indicators address the same consideration, analysis should be taken with a view to eliminating one of the indicators. This is based upon the practical issue that only a few vital indicators should be selected in order to minimise the burden of measurement at each level of the company and in order to provide only meaningful information to users.

The conceptual requirements were grouped into three main categories, namely meaningful, reliable and practical, in order to facilitate the subsequent *quality* screening process. The description of the categories is presented in Table A.10.1.

Table A.10.1: Quality considerations for MPIs.

Good characteristics	Description
Meaningful *Understandable*	Clearly defined Easy to communicate to stakeholders
Relevant	Relevant to the company's activities. Accomplishes specific objectives or targets Significant and useful to users
Long term oriented	Takes into account long-term effects such as impacts on cost and revenues, image, customer loyalty, etc.
Comparable	Allows comparison over time or with other companies, activities or standards.
Reliable	Representative and provide a clear picture of each selected priority. Responsive to changes internally and externally. Verifiable – can be reviewed and updated regularly. Consistent data source and accurate analytical method.

[3] Leading indicators (also referred to as business process indicators). The leading indicator measures internal practices or efforts that are expected to improve future performance (e.g. number of eco-efficiency audits, number of process redesigns) (Fiskel et al, 1999).

[4] Lagging indicators (also referred to as outcome indicators) are measures of the results or outcomes (e.g. reduction in air emission) that are attributable to improvements in a company's business processes. It represents a retrospective view of performance, and does not provide managers with foresights about future performance expectations.

Practical	Based on aspects that can be influenced or controlled. Simple to measure. Tailor made for the company's needs. Obtainable relatively easily and in a cost-effective manner. Appropriate number of key indicators.

Using the quality considerations presented in the above table as a reference, a screening table based upon the quality considerations was designed.

Pilot Testing of the EMPE System

In order to validate the applicability and practicability of the EMPE system, pilot testing was carried out with the participation of both environmental controllers from the parent company and environmental co-ordinators from subsidiaries. As an initial attempt, three subsidiaries were selected to participate in the study. The subsidiaries selected are in the progress of implementing an EMS that should be certified either by the end of year 2000 or by the end of year 2001.

The results of the pilot testing on the EMPE system were evaluated by giving scores and doing performance gaps.

The practicability and usefulness of the proposed EMPE system was based upon discussions with practitioners and academics, as well as on theoretical literature. The EMPE system was finally modified and improved.