Nordic Project on Environmental Performance Indicators in Industry

Environmental performance evaluation and indicators for external and internal communication

Case report from Cementa and Norcem

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REPORT OVERVIEW

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Resymè:

Norcem and Cementa participated in the NORDEPE-project to:

- Evaluate and further develop the already existing EPI-system in Norcem
- Develop Environmental Performance Indicators for Cementa based on ISO 14031, GRI Draft Guidelines and existing experience from the Cement Industry.
- Implement the indicators in internal management systems and external reporting systems.

To obtain these goals the project activities were concentrated on stakeholder assessments and routines for internal communication. The stakeholder assessments gave input to the development of the environmental management systems as well as improvement of the communication with internal and external stakeholders. Some of the results were used directly in the environmental report, others for internal environmental management and local use only.

The prioritised indicators are given below:

Ground use, use of natural resources / secondary raw materials, use of energy /use of secondary energy, water use, emissions of CO2 , SO2 , NOx, heavy metals to air, emissions to water, production related aspects (e.g. vibration, noise, aesthetics), sustainability Indicators for strategic use "green products" and health hazards in products.

A matrix was developed to ensure that targets are defined and results are measured in the environmental management system. The matrix has been proved useful for sorting out reporting routines. Cementa has implemented the matrix and defined routines to ensure that targets are defined and results are measured.

The project activities, represented by company internal project work combined with method development and exchange of experiences in joint Nordic project meetings, served as important drivers for project escalation. It gave also valuable knowledge on present activities and strategies in other (and larger) Nordic companies.

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0 Summary

Norcem and Cementa participated in the NORDEPE-project as one of 11 case companies from Sweden, Finland and Norway.

The motivation for participation was defined through the following project objectives:

- Evaluate and further develop the already existing EPI-system in Norcem
- Develop Environmental Performance Indicators for Cementa based on ISO 14031, GRI Draft Guidelines and existing experience from the Cement Industry.
- Implement the indicators in internal management systems and external reporting systems.

To obtain these goals the project activities were concentrated on stakeholder assessments and routines for internal communication. Norcem had been participating in an earlier project on EPI development (Vold, M. 1997). They had performed a stakeholder assessment and developed EPIs. Results from the 1996 study was used as basis for the activities in this case project as listed below:

1. Identify the most relevant applications of EPI systems in Cementa, and identify how EPI might be implemented in the processes of these applications
2. Describe existing indicators from Slite as a basis for evaluation of EPI systems
3. Identify the most significant environmental aspects related to Cementa, based on existing LCA studies
4. Identify the most significant stakeholder groups, and make surveys of the most important user requirements to EPI systems
5. Evaluate the relationships between stakeholder requirements and significant environmental aspects, and develop a set of indicators for the company
6. Evaluate the possibilities for measurements and analyses of emission data, and implement the indicators in the applications in Cementa.
7. Evaluate the use of EPI system in Norcem developed in phase I of the EPI project, and discuss further development of the system and its applications

In the case project carried out at Norcem and Cementa stakeholder assessments were performed. At Norcem it was lead by an external consultant and at Cementa by the internal project leader. These stakeholder assessments gave input to the development of the environmental management systems as well as improvement of the communication with internal and external stakeholders. Some of the results were used directly in the environmental report, others for internal environmental management and local use only.

The prioritised indicators are given in Table 0.1.

Table 0.1 Prioritised EPIs

Prioritised EPIs	Overall use	Local use
Ground use	X	
Use of natural resources / secondary raw materials	X	
Use of energy /use of secondary energy	X	
Water use		X
Emissions of CO2 , SO2 , NOx, heavy metals to air	X	
Emissions to water	X	
Production related aspects (e.g. vibration, noise, aesthetics)		X
Sustainability Indicators for strategic use "green products"	X	
Health hazards in products	X	X

A matrix was developed to ensure that targets are defined and results are measured in the environmental management system. The matrix has been proved useful for sorting out reporting routines. Cementa has implemented the matrix and defined routines to ensure that targets are defined and results are measured.

The project activities, represented by company internal project work combined with method development and exchange of experiences in joint Nordic project meetings, served as important drivers for project escalation. It gave also valuable knowledge on present activities and strategies in other (and larger) Nordic companies.

1 Introduction

In 1996/97, the first preliminary methods for Environmental Performance Evaluations and Indicators (EPE/EPI) in business organisation were developed by Norwegian and Swedish companies. This test phase identified areas for additional work, and gave input to the development of draft ISO standards for EPE and EPI (ISO 14031), EGT 1997.

Based on the preliminary experiences from this first phase of the EPI development, plans for the Nordic Project for Development and Implementation of Environmental Performance Indicators in Industry (NORDEPE) was developed.

The main aim of the NORDEPE-project was to develop and implement environmental performance indicators as an integrated part of environmental management systems, decision making processes and communication processes in the participating companies, and in the long term to increase eco-effectiveness and competitiveness of Nordic industry.

In the NORDEPE project, the following main activities were carried out:

1. Evaluating and testing quality and statistical properties of emission data with regard to environmental performance evaluation, e.g. benchmarking and rating of companies
2. Development and testing of indicators used for improvement of the environmental management and operational practices (BOP/BAT) in SME companies (Supply Chain Management Indicators)
3. Development and testing of indicators for strategic decision making, strategic development and vertical communication in large corporations, e.g. product portfolio development, technology innovations and sustainable development policies
4. Development and testing of performance indicators for external communication, with special emphasis on the needs of financial stakeholders (Indicators for Reporting and Green Rating).

Norcem had already participated in the Nordic project on Environmental Performance Indicators in 1996. Cementa and Norcem have been working together on different projects on sustainable cement and concrete. These projects have, amongst other things, resulted in LCI and LCA of cement production in the two companies and of average Nordic cement production. This work has contributed, together with German and Dutch works, to the LCI work on cement and concrete in Cembureau. When the plans for the Nordic Project for Development and Implementation of Environmental Performance Indicators in Industry (NORDEPE) were developed, Norcem and Cementa decided to participate in the project.

Ole Jørgen Hanssen from Østfold Research Foundation has served as project leader for the NORDEPE-project and reported to a steering group with the following members:

- Bjørn Sveen (Confederation for Norwegian Business and Industry),
- Inger Strömdal (Swedish Confederation of Industry)
- Helena Manninen (TEKES)
- Per Arne Syrrist (Peterson Linerboard)
- Lars Göran Bergqvist (AstraZeneca)

Chalmers Industriteknik (CIT), Technical Research Centre of Finland (VTT), Centre for Product Oriented Environmental studies (CPM) at Chalmers and Østfold Research Foundation (STØ) served as advisors and facilitators for their respective national companies participating in the project. A list of all participants from companies and institutes in this project as well as the list of reports from this project is given in annex 1. The reports can be ordered from the participating institutions.

2 Description of the company

2.1 Type of production and products

Both Cementa and Norcem produce Portland Cement. Portland cement is a hydraulic binder produced from limestone as a main raw material with quartzite rock or sand, bauxite, iron oxide and gypsum as supplementary components or corrective ingredients. Different qualities of cements are made to meet particular concrete specifications related to e.g. strength development and resistance to chemicals and corrosive conditions etc.

The cement is produced according to a dry process with homogenisation of raw materials in raw meal silos.

2.1.1 The production process of cement

The production of cement can be divided in five stages;

1. Mining of limestone
2. Grinding of limestone and other raw materials to raw meal
3. Burning of raw meal to clinker
4. Grinding of clinker to cement
5. Storage, dispatch of cement

The five stages are described below and illustrated in figure 2.1.

Mining of limestone

The limestone is mined in open quarries and mines. The content of $CaCO_3$ in the limestone differs, but is normally between 60 - 95%. The limestone is crushed and transported to storage facilities.

Grinding of limestone and additives to produce raw meal

The raw materials (crushed limestone, quartzite, bauxite, iron oxide, etc.) are stored in separate raw material hoppers before they are fed into the raw meal mills. The raw meal is then transported to silos for homogenisation and storage. Depending on the specifications of the clinker and the cement, raw meal can be made in different qualities.

Burning of raw meal to produce clinker

The clinker production takes place in a rotary kiln system where the materials are heated up to 1450^{o}C. In this process the raw meal is preheated, calcined (CO_2 expelled) and sintered to granules (small balls) - the clinker. The clinker is cooled in air-coolers before transport to silos for storage.

Coal and petcoke have traditionally been used as fuel for the rotary kilns, but now other types of fossil fuel are used. In the Nordic and many other countries, waste and hazardous waste are used. More than 50% replacement is quite normal.

Grinding of clinker to produce cement

The clinker is ground in cement mills together with 3 -7 % gypsum, which is added to control the setting time. Other additions such as limestone, fly ash and blast furnace slag may be added in the grinding process to modify cement properties, to produce special qualities of cement and reduce the environmental load..

Storage, dispatch of cement

After the grinding process the cement is conveyed to storage silos. Some cement is bagged. Most of the cement is dispatched from the factory in bulk by ship and lorries.

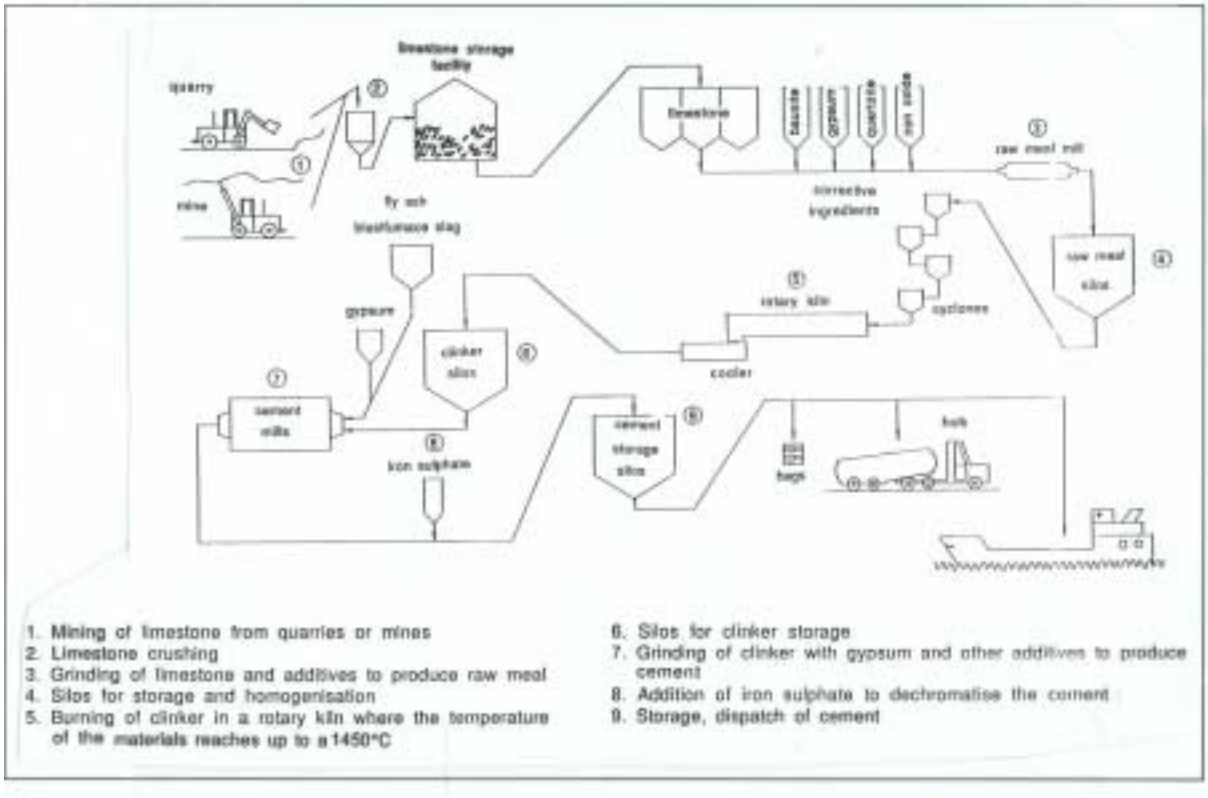

Figure 2.1*: *Cement production

2.2 Volumes of Nordic cement-production

Table 2.1 describes the total production volumes for cement in Norway and Sweden in 1999, divided into volumes sold within the home market and the exported volumes.

Table 2.1: Production and sale figures on cement in Norway and Sweden (1999).

Cement	Production, total (1000 ton)	Home market, (1000 ton)	Export, total (1000 ton)
Norway	1711	1114	533
Sweden	2296	1515	781

2.3 Number of employees (1999)

Norcem, Brevik plant: 252 employees

Cementa, Slite plant: 300 employees, of whom 60 are employed within the shipping company

2.4 Environmental/quality systems implemented in the organisation

	Norcem	Cementa
EMAS	x	
ISO 14001	x	x
ISO 9001	x	x
LCA as management tool	x	x

These, already established, environmental and quality routines turned out to be a good basis for the further EPI development work.

2.5 The reasons why the company entered the NORDEPE-project

Norcem had already developed a set of when they participated in the Nordic project on Environmental Performance Indicators in 1996. When the plans for the Nordic Project for Development and Implementation of Environmental Performance Indicators in Industry (NORDEPE) were developed Norcem and Cementa decided to participate in the project.

They wanted to:

- Evaluate and further develop the already existing EPI-system in Norcem
- Develop Environmental Performance Indicators for Cementa based on ISO 14031, GRI Draft Guidelines and existing experience from the Cement Industry.
- Implement the indicators in internal management systems and external reporting systems.

3 Project Objectives and Organising

3.1 Objectives

The main aims of the NORDEPE-project were to develop and implement environmental performance indicators as an integrated part of environmental management systems, decision making processes and communication processes in the participating companies, and in the long term to increase eco-effectiveness and competitiveness of Nordic industry.

Objectives for the case project were to:

1. Identify the most relevant applications of EPI systems in Cementa, and identify how EPI might be implemented in the processes of these applications
2. Describe existing indicators from Slite as a basis for evaluation of EPI systems
3. Identify the most significant environmental aspects related to Cementa, based on existing LCA studies
4. Identify the most significant stakeholder groups, and make surveys of the most important user requirements to EPI systems
5. Evaluate the relationships between stakeholder requirements and significant environmental aspects, and develop a set of indicators for the company
6. Evaluate the possibilities for measurements and analyses of emission data, and implement the indicators in the applications in Cementa.
7. Evaluate the use of EPI system in Norcem developed in phase I of the EPI project, and discuss further development of the system and its applications

3.2 Organising of the project.

The case project was organised with network meetings of a working group. The working group consisted of:

- Gunnel Pott, Cementa Slite
- Erik Stoltenberg-Hansson, Norcem
- Ida Husum, Norcem
- Ole Jørgen Hanssen, Østfold Research Foundation
- Mie Vold, Østfold Research Foundation
- Bo von Bahr, CPM

The plans for work and progression in the projects were discussed in the working group meetings. The company representatives alone performed most of the work in the companies.

4 Project Methodology

4.1 Project Methodology

The project followed the general methodology given by ISO 14031 ”Environmental Performance Evaluation” as well as the internal methodology developed in the NORDEPE project[1]. A brief outline of the methodology is given by figure 4.1:

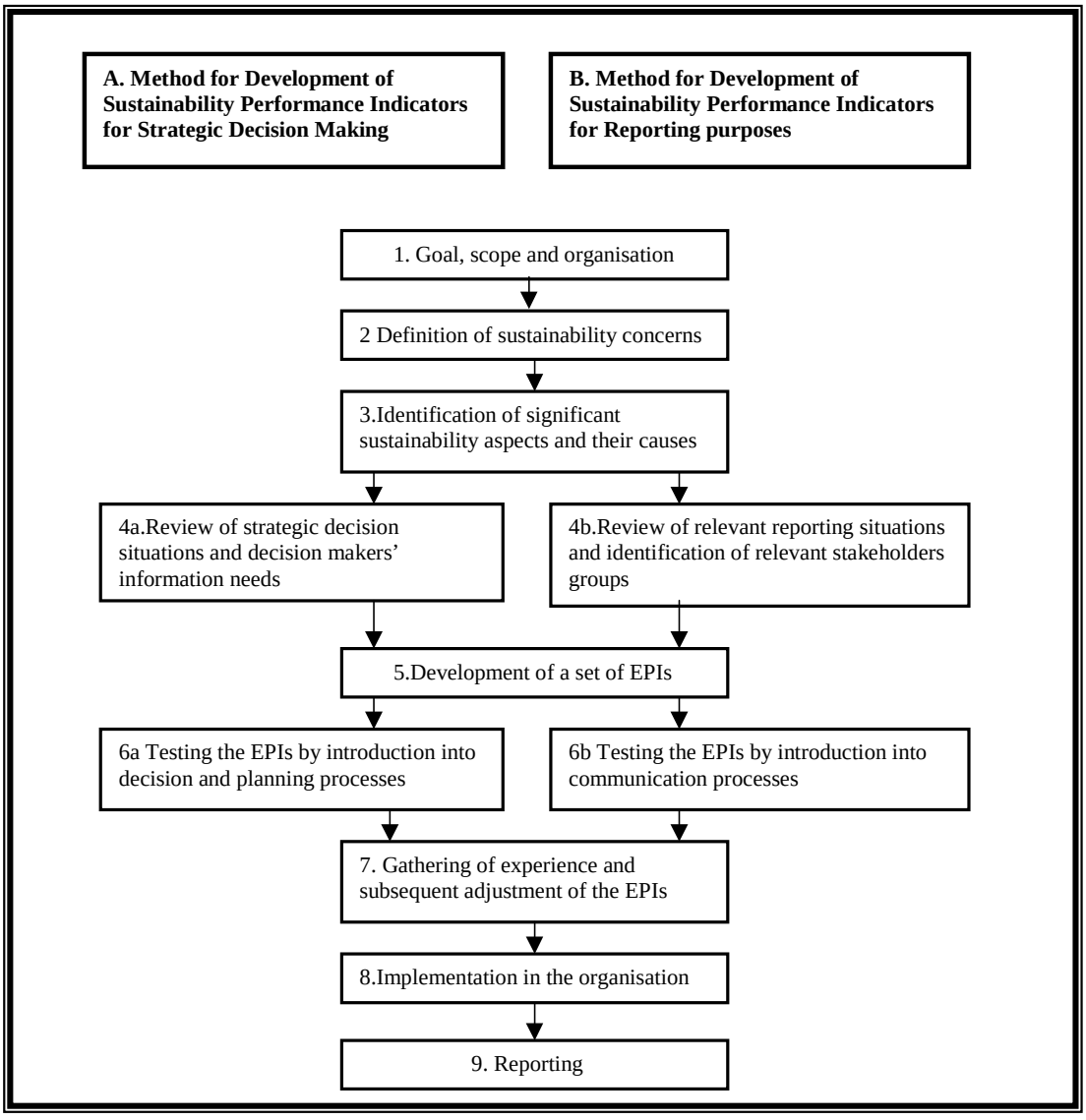

Figure 4.1: General methodology for development of Environmental Performance Indicator

[1] See Main report from the project (Thoresen, J. Et.al.; "Main report from the Nordic project for development and implementation of Environmental Performance Indicators in Industry")

General principles for selection and implementation of indicators is according to

- *ISO 14031 "Environmental Performance Evaluation"*
- *Internal method descriptions developed in the project. (*Bahr, B. Et.al; "Statistical properties for emission data in the Nordic Cement Industry", Thoresen, J, et.al,; "Methodological approach for development of indicators for strategic decision making in industrial companies")

4.2 Specific project methodology

The general framework given in figure 1 was modified and adjusted to the case project, and resulted in this project plan:

- Perform an environmental assessment, based on existing documents and significant environmental aspects in ISO 14001 and EMAS.
- Perform stakeholder assessments.
- Develop a plan for implementation and internal reporting
- Test developed areas for indicators on the company management group.
- Development of EPIs for strategic management
- Develop indicators for internal reporting and external communication- Implementation of results from internal reporting in the environmental report.

5 Results

5.1 Environmental assessment

The aim of the environmental assessment step was to get an overview over the main parameters and environmental issues, which should be focused upon in the EPI development work. All existing, relevant reports for environmental reporting were gathered and assessed to find the most important parameters reported today.

Cementa and Norcem were already ISO 14001 certified (Norcem was also EMAS registered). Significant environmental aspects identified in these systems were taken into account.

5.2 Stakeholder assessment

The selection of EPIs should be based on the stakeholders' views and the requirements of interested parties, in order to identify specific needs not necessarily covered by the environmental impact assessment. This assessment could also include information regarding how to communicate environmental information. This implies that the company must identify it's main stakeholders and their needs and requirements for information.

Indicators describing the condition of the environment (ECIs) were not emphasised in the original project plan, but it was encouraged to express «causes and effects» in indicator sets. For example emission of dust may be described both as process emissions and as dust fallout in the neighbourhood.

Relevant stakeholders to cement industry:

- Customers
- Neighbours
- Non governmental organisations (NGO's)
- Media
- Politicians
- Assurance
- Banks
- Financing/owners/concern
- Employees
- Plant Management
- Local authorities / local municipality
- National authorities
- Research and development

5.2.1 Stakeholder assessment, Norcem:

When Norcem participated in an EPI development project in 1996, a broad project group was established. The members had been participating in the earlier assessments, and they felt that they had a good overview of the voice of the local public. The working group found it therefore sufficient to interview a group of key persons to get their knowledge regarding different stakeholders interests. Following key persons were interviewed:

- Leader of the Brevik resident Association
- Company Medical doctor
- Finance manager
- Sales manager

Parameters found as important in 1996 were:

- Energy use
- Emissions of CO2
- Emission of dust
- Emission of heavy metals
- Health aspects in production
- Noise
- Aesthetic properties
- Green products

In 1999 Norcem decided to participate in this new EPI project. They wanted see if the interests of the stakeholders had changed during the previous three years. The result of the environmental assessment was assumed to be the same as in 1996.

This time there was no project group established at Norcem and it was therefore decided to interview a broader group of stakeholders. The following key persons were interviewed:

- Customers, represented by the Sales Manager
- Citizens of Brevik, represented by the leader of the Brevik Resident Association
- Non governmental organisations (NGOs) (i.e. Norges Naturvernforbund)
- Assurance/Bank represented by the Finance Manager of Norcem Brevik
- Financing/owners/concern
- Employees represented by the Safety Officer and Company Medical Doctor
- Management of the plant,
- Local authorities (i.e. SFT Grenland)
- National authorities (i.e. SFT Oslo)
- Other interests, represented by the Information Manager

An external consultant led the interviews.

As assumed the stakeholder assessment gave the one from 1996. All parameters found in 1996 were also seen as important in this one. In addition three new parameters were registered. These were:

- water emissions,
- vibrations
- health hazard effects from products.

5.2.2 Stakeholder assessment, Cementa Slite:

In Cementa the company representative herself performed the stakeholder assessment. Interviewing the group of stakeholders, presented in table below, performed the assessment. The table also indicates the stakeholders' main area of interest.

Stakeholder	Overall interest	Local interest
Local management	X	X
Central management	X	
Neighbours		X
Employees	X	X
Owners		X
Local and central authorities	X	X
Customers	X	
Pressure groups	X	X
Governmental goals	X	X

5.3 Prioritising and Selection of Indicators:

Different sources of information were used as background information for prioritisation and selection of EPIs:

- environmental impact assessment (including ISO 14001-document and other earlier reports, LCA-studies etc.)
- parameters reported to the authorities
- stakeholder assessment.

The most important parameters were identified by accordance between two of the three sources of information. These parameters were selected as important parameters on a corporate level. The working group also assumed that the same parameters were the most important on a local management level. Figure 5.1 shows the comparison between the three information sources used as the basis for the prioritisation process.

	Stakholder Assessment			ISO 14001 (Cementa)	Life Cycle Assessment	Conclution	
	Norcem 96	*Norcem 99*	*Cementa Slite*		*LCA*	*Overall interest*	*Local interest*
Resource depletion							
Ground use			x	x		**x**	
Use of natural resources			x			**x**	
Energy use	x	x	x	x	x	**x**	
Fossil fuel				x	x	**x**	
Water use			x				**x**
Emissions							
CO2	x	x	x	x	x	**x**	
SO2				x	x	**x**	
NOx				x	x	**x**	
Dust	x	x	x	x			**x**
Heavy metals	x	x	x		x	**x**	
Emissions to water		x	x			**x**	
Other production related aspects							
Health aspects, production	x	x	x				**x**
Vibrations		x	x				**x**
Noise	x	x	x				**x**
Aestetics	x	x					**x**
Product related apects							
"Green products"	x	x	x			**x**	
Health hazards, product		x	x			**x**	

Figure 5.1 Comparison between different sources for prioritisation and selection of EPIs

Based on the comparison the following parameters were prioritised:

Prioritised EPIs	Overall use	Local use
Ground use	X	
Use of natural resources / secondary raw materials	X	
Use of energy /use of secondary energy	X	
Water use		X
Emissions of CO2 , SO2 , Nox, heavy metals to air	X	
Emissions to water	X	
Production related aspects (e.g. vibration, noise, aesthetics)		X
Sustainability Indicators for strategic use "green products"	X	
Health hazards in products	X	X

Chapter 5.6 shows how some of the prioritised indicators have been used in external communication.

5.4 EPI's for Strategic Management

The stakeholder assessment and environmental impact assessments had identified and prioritised important environmental aspects and EPIs. This information can be used to perform an assessment on strategic management level on products or product groups.

	Consumption of natural resources	Ground use	Fossil fuels	Energy, total
4		65 % critical resources		
3	None secondary raw material	50 % critical resources		Product type A
2	15 % secondary raw material	30 % critical resources	Max. 35 % secondary fuels	20 % less fuels electricity unchanged
1	35 % secondary raw material	15 % critical resources	Unlimited secondary fuels	35-40 % less fuels electricity unchanged

Figure 5.2 Example on criteria used to evaluate the cement products from Cementa

First step is to identify a set of criteria for evaluation of the relevant products with respect to a broad set of environmental aspects. . An example of a criteria set for some indicators is shown in Figure 5.2. When a product is analysed, it will be given a value from 1 to 4 in each category of aspect, based on how it fulfils the criteria (1 is best, 4 is worse).

The values for each of the categories are summed up to give a total for each product. In figure an example of a matrix with 7 products (A to G), their value in each of the categories and total sum are shown.

Cement, product types	Consumption of natural resources	Ground use	Energy use	Fossil fuel	CO_2 emissions	NO_x emissions	Heavy metals	Health aspects, production	Vibrations from blasting, noice	Waste	Use of chemicals	Transports within the works	Transports outside the works	Valuation, total
A	3	2	3	1	4	3	2	2				1	2	23
B	2	3	2	1	3	2	3	3				2	3	24
C	3	4	4	1	4	3	2	2				1	2	26
D														
E	3	4	4	1	4	3	3	3				2	3	30
F	1	1	1	2	1	1	3	3				1	3	17
G	3	2	2	1	2	2	2	2				1	2	19

Figure 5.3 Evaluation results of 7 different cement products from Cementa

The total score in Figure 5.3 indicates high or low environmental score for the product and how the products are ranked compared to each other. A product with low environmental impact (low total score), will in total sum show the best environmental performance (product F in Figure 5.3).

In the Environmental Strategy Matrix shown in Figure 5.4, the same group of products is ranked both according to environmental performance and market value. This gives a good basis for a more strategic evaluation of how to use resources in environmental projects in the company. The matrix can also be the basis for definition of more strategic indicators in Cementa.

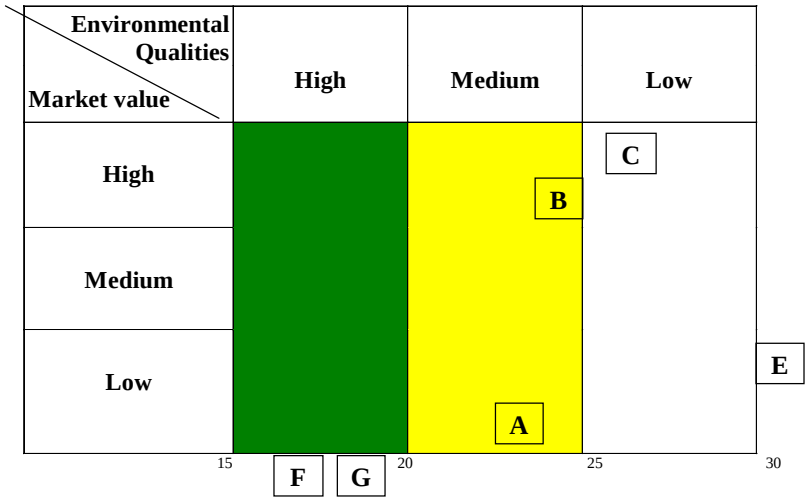

Figure 5.4 Environmental Strategy Matrix Approach for Cementas products

The matrix shows that the traditional products with high market value, are the products with lowest environmental profiles. The new products (F&G) with the best environmental profile, have so far low or in fact no marked value.

It is quite clear from this matrix, that Cementa should use its main resources in product and process improvements related to product B and C, while marketing resources should be used intensively on products F and G. If product F and G can take some of the market from B and C, Cementa's total environmental profile would improve from such a market shift.

As a basis for strategic indicators, the matrix could be used to define indicators for strategy development as for instance:

> *Share of "green products" (better than 20 in value in Figure 5.3) shall be at least 10% in 2005 and at least 25% in 2010.*

This overall indicator can be broken down to more specific indicators for the market division, in sales targets for products F and G, and for the product development to bring product B beyond value 20 before 2005. Both options will contribute to achieve the strategic target.

5.5 IMPLEMENTATION

5.5.1 Internal environmental reporting

A hard part of implementation of an environmental management system is often to clarify and ensure that targets are defined and results are measured. It is important that the system does actually bring about change. To sort out who is in need of what type of information and how often he/she needs the information, an environmental indicator matrix was developed.

The columns represent different levels in the in the company hierarchy, in addition to levels of external communication.

The rows represent the different significant environmental aspects identified during the environmental and stakeholder assessments.

In all cells of the matrix, answers to the following questions should be given:

What to report?
How is it to be reported?
To whom?
From whom?
How often?

A matrix was developed for the cement industry. Cementa chose to implement the matrix to sort out and follow up routines for internal and external communication. The main philosophy behind the matrix is to follow connections between internal functions and responsibilities, and environmental aspects and target areas. Each cell represents such a cause-effect relationship through a given EPI.

Table 5.1 shows the matrix used for reporting environmental management routines at Cementa Slite.

Table 5.1 Reporting matrix for Cementa Slite

		Leader of function	Plant management and employees	Concern management	Environmental report
Natural resources and secondary raw materials	*To whom?*	Quarry and production manager			
	What?	* m^3/ton from critical or sensitive areas * secondary raw material, %	* distribution between critical and non critical resourses * total, ton/ton cement * secondary raw material, %	* total, ton/ton cement * secondary raw material, total	* total, ton resouses/ton cement * development during last 5 years + goals * secondary raw materials, %
	How often?	Continously	Monthly	Monthly	Yearly
Water use	*Til hvem?*	Function of water source			
	Hva?	* m^3/hour * Level of water in source	* Days with levels below critical level		* Total, m^3/ton cement
	Hvor ofte?	Continously	Monthly		Yearly
Use of fuel and energy	*To whom?*	Responsible for energy sources			
	What?	* MJ/ton clinker * kWh/ton clinker, cement, others * use of Surplus energy, MJ/ton clinker * secondary fuels, %	* As for function manager	* as for function manager * and development over time.	* MJ/ton cement and total * % divided * development over lat 5 years * goals for next periode * surplus energy MJ/ton cement * secondary fuels, % * electricity, -> absoulute figures GWh -> kWh/ton cement
	How often?	Continously	Monthly	Monthly	Yearly
CO2, SO2 and Nox	*To whom?*	Production manager			
	What?	* mg/Nm^3	* mg/Nm3 * development over time * emissions / ton clinker	* mg/Nm3 * development over time	* total emissions -> emissions /ton cement -> mg/Nm^3 * development over time Divided on sources (process/ transport og energy)
	How often?	Continously	Monthly	Monthly	Yearly
Dust	*To whom?*				
	What?	* Complaints * mg/Nm3	* development over time * emissions / ton clinker	* As function manager * and development over time	See CO_2, SO_2 and NOx
	How often?	Continously	Monthly	Monthly	Yearly
Noise	*To whom?*				
	What?	* complaints	As function manager		* development over time * goals
	How often?	Continously	Monthly		Yearly
Vibrations	*To whom?*				
	What?	* complaints * level, vibration	As function manager		* development over time * goals
	How often?	Continously	Monthly	Yearly	Yearly

5.6 External communication

Both Norcem and Cementa have used their experiences from the project in the development of their environmental report. Most of the prioritised EPIs are presented in these reports.

Norcem and Cementa have chosen to present EPIs on:

Indicators presented	Norcem, Brevik	Cementa, Slite
Use of natural resources	X	X
Use of secondary raw materials		X
Total use of fuels and energy	X	X
Use of surplus energy		X
Use of secondary fuels	X	X
Emissions of sulphur dioxide	X	X
Emissions of nitrogen dioxide	X	X
Emissions of CO_2	X	X
Emissions to air of dust	X	X
Emissions of TOC, Chlorinated compounds, fluorinated compunds, heavy metals	X	
Waste	X	
Noise and vibrations		X

5.6.1 Examples of important environmental aspects presented as indicators.

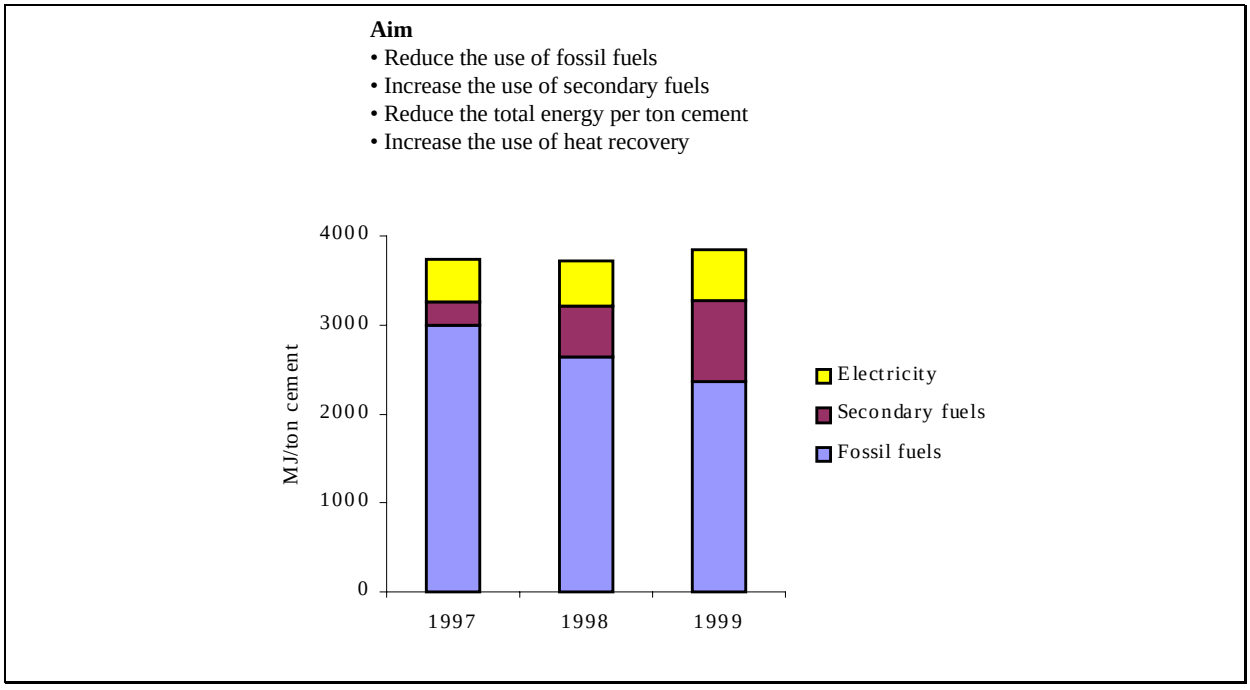

Figure 5.5 EPI, Use of fuels and energy at Cementa Slite

Figure 5.5 shows an example of how use of fuels and electricity can be presented as an Environmental Performance Indicator (EPI). The figure shows both the aim of using the indicator and the development over the last 3 years.

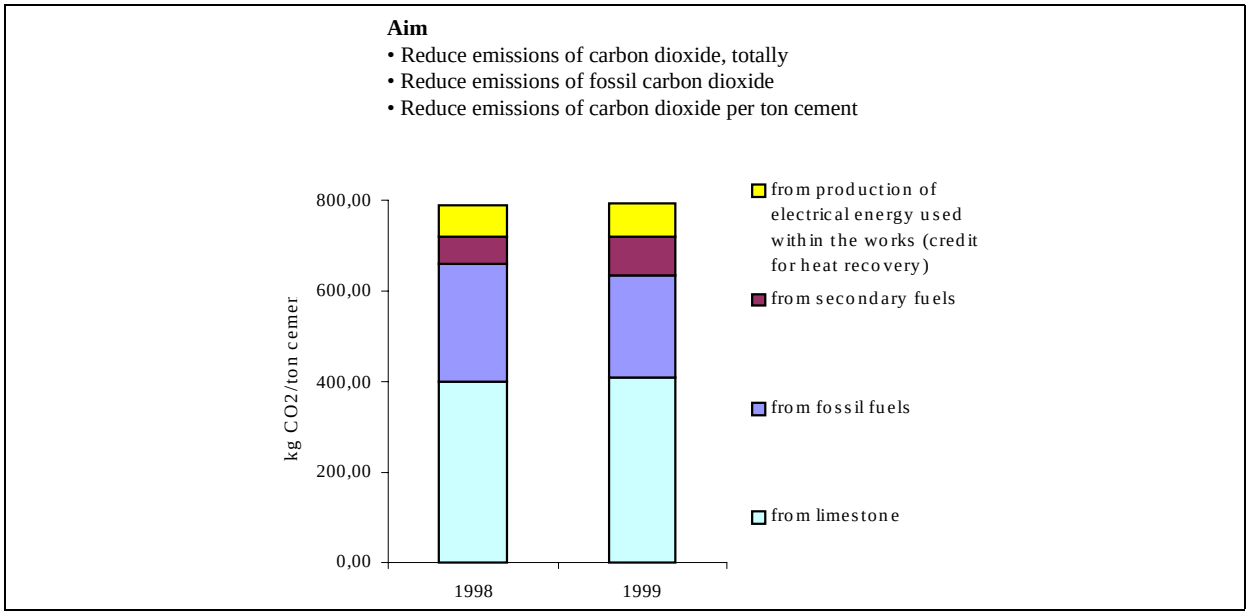

Figure 5.6 EPI, emissions of greenhous gasses from Cementa Slite

CO2 is often an energy-related emission. In the production of cement CO2 is also emitted due to decarbonisation from the limestone. This is important to communicate. Figure 5.6 shows how Cementa has chosen to present their CO2 emissions as an EPI and also the aim of the EPI.

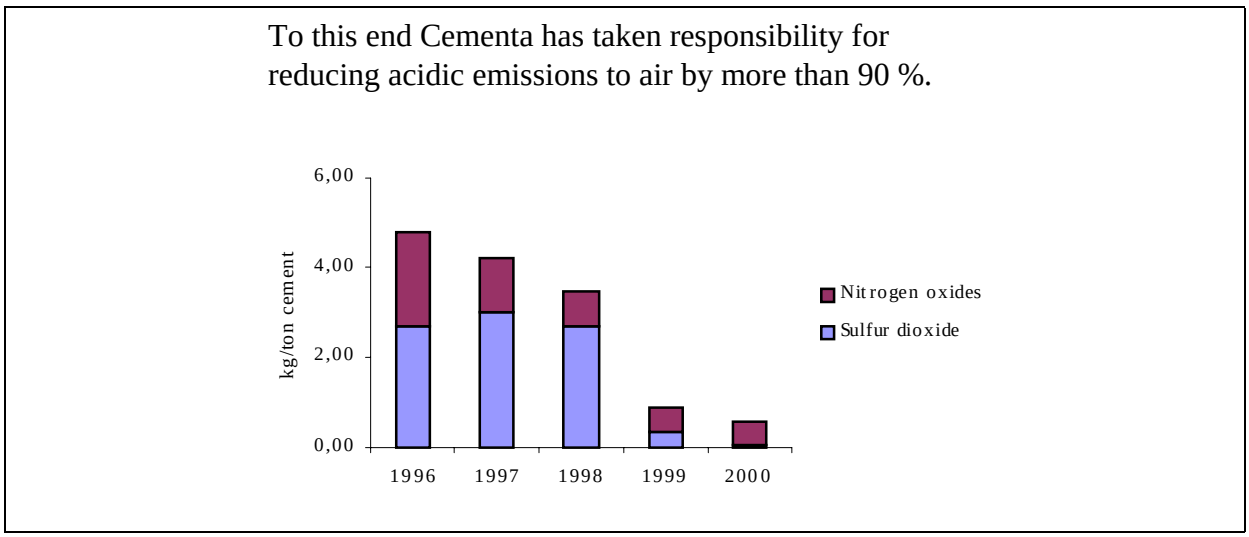

Figure 5.7 EPI, acidifying substances from Cementa Slite.

Cementa Slite had set their goal to reduce their emissions of acidifying substances by more than 90% in period from 1996 to 2000. They have made it, and this is important to communicate. 5.7 shows how Cementa Slite has chosen to present their performance due to emissions of acidifying substances in the period from 1996 to 2000.

6 Discussion

6.1 Discussion of method(s) applied

The project group found it important that the specific needs and conditions in the companies drove the EPI developing process. By this approach, the EPI cover specific environmental areas important for the company, and they are based on existing or accessible data. This was regarded as one success key for later implementation and use.

The participation in the Nordic project, which included activities such as method development and exchange of experiences with the total project group, has also been useful.

6.2 Discussion of the results

Many of the results from the case project have already been implemented in the organisations, and others will be implemented in the near future. The project has thus been very useful for developing the environmental management systems and planning of the communication processes with internal and external stakeholders.

It is important that environmental management system does actually bring about change. It is therefore important to clarify and ensure that targets are defined and results are measured. The matrix developed seemed to be helpful to sort out who is in need of what type of information and how often he/she needs the information.

6.3 Discussion of data quality and data availability

Environmental aspect	Relevant indicator	Comment on data quality
Natural resources and secondary materials	m^3/ton from critical or sensitive areas secondary raw materials, % of total materials	Difficult to define critical/sensitive area Measured and reported
Use of energy	Total energy use per produced unit, divided on fossil fuel, surlplus energy and secondary energy	Measured and reported
Emissions to air of CO_2,	Kilogram CO_2 per produced unit, divided on source	Concentration can be and is continuously measured in some plants. Exactly stream of smoke gas is continuously measured in some plants.
Emissions to air of NOx, SO_2, dust	Gram emissions, specified, per produced unit.	Concentration is measured continuously Exactly stream of smoke gas is continuously measured in some plants.
Emissions to air of TOC, Chlorinated compounds, fluorinated	Milligram of emissions, specified, per produced unit	TOC, HCl, Hg are measured continously in some plants.

compounds and heavy metals		

7 Conclusion

- In the case project carried out at Norcem and Cementa stakeholder assessments were carried out, at Norcem lead by an external consultant and at Cementa by the internal project leader. These stakeholder assessments gave input to the development of the environmental management systems as well as improvement of the communication with internal and external stakeholders. Some of the results were used directly in the environmental report, others for internal environmental management only.
- Development of a reporting matrix has been proved useful for sorting out reporting routines. Cementa has implemented the matrix and defined routines to ensure that targets are defined and results are measured.
- The project activities, represented by company internal project work combined with method development and exchange of experiences in joint Nordic project meetings, served as important drivers for project escalation. It gave also valuable knowledge on present activities and strategies in other (and larger) Nordic companies.

Annex 1: Project participants

Case companies:

Companies	Sector	Contact person
Tetra Pak S-22100 Lund	Packaging production	Lars Lundahl
Akzo Nobel S-44485 Stenungsund	Chemical production	Bertil Norberg Klas Hallberg
The Peterson Group N-1501 Moss	Pulp and paper production	Per Arne Syrrist Ellen Hilde Grøm
Sydkraft SE-20509 Malmö	Energy production	Rolf Henriksson Maria Sunér
Norsk Leca N-0614 Oslo	Construction materials	Knut Vaage
FORTUM Power and Heat Fin-00048 Fortum, VANTAA	Energy production	Pekka Järvinen Hannu Härkönen
UPM-Kymmene FIN-00101 Helsinki	Pulp and paper production	Kari Ebeling Nina Norjama
Norcem N-3950 Brevik	Cement production	Erik Stoltenberg Hansson
Cementa AB S-620 30 Slite	Cement production	Gunnel Pott

Following companies:

Companies	Sector	Contact person
STORA ENSO Group FIN-00101 Helsinki	Forest industry	Anneli Suotsalo
Lännen Tehtaat Oy FIN- 27821 ISO-Vimma	Food Production & Engineering	Juhani Hvitfelt
METSO Corp FIN 00101 Helsinki	Forestry	Pirjo Kaivos
Elkem N-0303 Oslo	Ferroalloys and silicon metal	Inger Johanne Eikeland
Statsbygg (N), N-0032 Oslo	Real estate	Zdena Cervenka Stein Rognlien
ESAB SE-40277 Göteborg	Welding and cutting equipment	Stefan Larsson

Volvo Personvagnar SE-40508 Göteborg	Car manufacturing	Agneta Wendel
Perstorp SE-28480 Perstorp	Chemical production	Henrik K. Ny

Participating institutions:

Institute	Participating councellors	Addresses
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Technical Research Centre of Finland, VTT	Rabbe Thun Virve Tulenheimo	***P.O.Box. 1403, FIN- 02044 VTT, Espoo*** Phone: +358 9 456 5450 Fax: +358 9 456 7043 www.vtt.fi
Centre for Environmental Assessment of Product and Material Systems (CPM)	Bo von Bahr Bengt Steen	Chalmers University of Technology, Kapellgången 5, S-412 96 Göteborg Phone: +46 317722177 Fax: +46 317722172
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Associated Partners:

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IIIEE Lund University	Mikael Backman Philip Peck Murat Mirata Zinaida Fadeeva Yoke Mun Chan, Joscelyne M. Shaw, Narine Sargsyan, Anastasia O'Rourke Jaakko Kuisma	Lund University P.O.Box 196 S-22100 LUND, Sweden Phone:+46 46 222 0200 Fax: +46 46 222 0210

Participating SME-companies within the transport sector:

Company	**Contact person**
Jørgensen Transport AS	Ivar Jørgensen
Sørum Transport AS	Harry Nilsen
Haukebøe Transport AS	Elling Haukebøe
Kristian Gerhard Jebsen Skipsrederi AS	Haktor Øvrevik

8 Annex 2: Project Reports

The reports from the project can be downloaded on the homepage of the Nordic Industrial Fund: http://prosjektweb.nordicinnovation.net/public/ - look up on NORDEPE.

Reports can also be ordered from the institutions responsible for the development of the documents, i.e. the first institution given in the list of authors.

Main report from the Nordic project for development and implementation of Environmental Performance Indicators in Industry.

Johan Thoresen ,Elin Økstad & Ole Jørgen Hanssen, Østfold Research Foundation. Norway, Bo von Bahr & Bengt Steen, CPM, Chalmers University of Technology, Sweden; Elin Eriksson & Petra Bäckman, Chalmers Industriteknik, Sweden, Rabbe Thun & Virve Thulenheimo, VTT Industrial Environmental Economics

METHODOLOGY REPORTS

Statistical Properties of Emission Data in the Nordic Cement Industry

Bo von Bahr, CPM, Chalmers University of Technology, Sweden; Ole Jørgen Hanssen & Mie Vold, Østfold Research Foundation, Norway, Gunnel Pott, Cementa AB, Sweden and Erik Stoltenberg-Hansson, NORCEM, Norway

Environmental Supply Chain indicators for the transport sector. Methodological approach and examples.

Lars von Krogh, Ole Jørgen Hanssen & Elin Økstad: Østfold Research Foundation, Norway

Performance Indicators for External Reporting and Green Rating

Virve Tulenheimo, VTT Industrial Environmental Economics, Finland; Petra Bäckman, Chalmers Industriteknik, Sweden and Elin Ökstad, Østfold Research Foundation, Norway

Methodological Approach for Development of Indicators for Strategic Decision-making in Industrial Companies

Johan Thoresen, Østfold Research Foundation, Norway; Elin Eriksson, Chalmers Industriteknik, Sweden and Rabbe Thun, VTT Industrial Environmental Economics, Finland

Methodology Approach for Selection of Significant Environmental Aspects

Bengt Steen, CPM, Sweden

CASE STUDIES

Akzo Nobel AB

Development of a Process and a Measurement System to Achieve Continuous Reduction of the Ecological Effects of Operations and Products at Akzo Nobel Surface Chemistry

Klas Hallberg, Akzo Nobel; Elin Eriksson, & Ulf Östermark, CIT, Sweden

Akzo Nobel AB

CEMENTA AB and NORCEM

Environmental performance indicators for external and internal communication

Case report from Cementa and Norcem

Mie Vold & Ole Jørgen Hanssen, Østfold Research Foundation, Norway, Gunnel Pott, Cementa, Sweden; Erik Stoltenberg-Hansson, Norcem, Norway; Bo von Bahr, CPM, Sweden

FORTUM Power and Heat Oy

Backcasting for Sustainable Strategies in the Energy Sector

Jaakko Kuisma, IIIEE, Lund University, Sweden; Virve Tulenheimo & Rabbe Thun, VTT Industrial Environmental Economics, Finland and Pekka Järvinen, FORTUM Power & Heat Oy, Finland

The Peterson Group

Environmental performance indicators for communication in the local community.

Elin Økstad, Østfold Research Foundation, Ellen Hilde Grøm, Peterson Linerboard, Norway

a.s. Norsk Leca

Environmental Performance Indicators for Strategic Decision making

Johan Thoresen, Østfold Research Foundation, Knut Vaage, as Norsk Leca

SYDKRAFT AB

Development and Testing a System for Benchmarking of Environmental Management Performance

Yoke Mun Chan, IIIEE, Lund University, Sweden; Rabbe Thun, VTT, Finland and Maria Sunér, Sydkraft, Sweden

Identification of Internal Indicators for Sustainable Corporate Decision-Making – A feasibility study for the establishment of business-related travel

Joscelyne M. Shaw, IIIEE, Lund University, Sweden; Rabbe Thun & Virve Tulenheimo, VTT Industrial Environmental Economics, Finland and Maria Sunér, Sydkraft, Sweden

Sustainable Development and Corporate Reporting: Selecting Indicators from Stakeholder Dialogue

Narine Sargsyan, Lund University, Sweden; Rabbe Thun & Virve Tulenheimo, VTT Industrial Environmental Economics, Finland and Maria Sunér, Sydkraft, Sweden

Corporate Environmental Assessment and Strategic Acquisitions

Anastasia O'Rourke, IIIEE, Lund University, Sweden; Rabbe Thun & Virve Tulenheimo, VTT Industrial Environmental Economics, Finland and Maria Sunér, Sydkraft, Sweden

Tetra Pak AB

Identification of Strategic Environmental Performance Indicators

Lars Lundahl, Tetra Pak; Elin Eriksson & Ulf Östermark, CIT, Sweden

UPM-Kymmene Oyj

Indicators for Sustainable Strategies based on Backcasting the Future

Rabbe Thun & Virve Tulenheimo, VTT Industrial Environmental Economics, Finland; Kari Harjunen & Ari Tiihonen, PricewaterhouseCoopers, Finland and Kari Ebeling & Nina Norjama, UPM-Kymmene Oyj, Finland