



**GreenPack: Green Electronics Packaging and Environmental
Data Flow Management**

Final Report from GreenPack Phase 1

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**A joint industrial research and networking initiative
supported by the Nordic Industrial Fund**

Preface

This report summarises the results from “GreenPack: Green Electronics Packaging and Environmental Data Flow Management. Phase 1” which was carried out from May 1999 till August 2002. The project was made possible thanks to profound funding by the Nordic Industrial Fund (project number P98156), company membership, and in-kind work by member companies.

The work was carried out together with a Steering Group made up of the member companies (given in Appendix 1).

The project was part of the Nordic Industrial Fund programme on Sustainable Industrial Production. In January 2001 it received EUREKA status (E!2523).

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The research team would like to express its thanks to the Steering Group for constructive discussions and support during the course of the project.

IVF, Sweden October 2002

Carl Gunnar Bergendahl
Project Manager

Front cover

Will you go ostrich?

A natural response to winds of change is to hide the head in the sand hoping the wind will die down. This may be a good strategy in some cases. However, the environmental challenge is here to stay and GreenPack is a way to prepare yourself for the inevitable changes.

(From the GreenPack marketing brochure)

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1 Summary

The development in electronics has resulted in products with rapidly increasing functionality, lower weight and less volume, giving users big advantages in the use phase. With its complex composition, an increasing number of new applications, shorter product life, use of hazardous substances and lack of data on the material contents, electronic and electrical (EE) products constitute a threat to both man and the environment.

EE manufacturers and their suppliers will face a number of important challenges in the near future affecting their business. These are among others emerging EU directives, an increasing need to know the materials contents of products, a need to design and build products in an environmentally conscious and profitable way and a need to build relations with other actors in the electronics eco-cycle. And last but not least: New business opportunities for companies being pro-active.

GreenPack started in 1999 with the objective of making electronics companies adopt environmental skills in management and product development and benefit commercially from these skills.

Phase 1 shows that there is widespread lack of awareness of commercial benefits of integrating ecodesign in product development at upper management in Nordic companies. This is serious as a shift towards a market favouring green products may come about fast. Moreover, there is an increasing gap between large companies and SMEs in terms of environmental awareness and competence.

Top management has a crucial role in devoting resources to middle management. Experiences from the automotive industry, now facing the End of Life Vehicle (ELV) directive, show that it is important to act before a directive comes to force.

The results from Phase 1 include

- A Materials Declaration Tool facilitating acquisition of materials data along supply chains
- A survey of commercial success stories from integrating eco-design into product development and an introduction to life cycle cost assessment
- An assessment of the status of environmental work in Nordic EE companies by means of two surveys (2000 and 2002)
- Seven workshops and seminars and one European conference
- Extensive networking with actors in Europe, USA and Japan

In all more than 150 Nordic companies have participated in the events of GreenPack Phase 1.

There is a demand from industry for continued work in GreenPack focusing on materials declaration and on increasing the awareness about new industrial and legislative developments and the commercial opportunities of going green.

2 Conclusions

These are the main conclusions from GreenPack Phase 1

- 1 Materials declaration of products and components is becoming increasingly important. The GreenPack Materials Declaration Tool successfully supports EE companies in acquiring materials data along supply chains and meeting customer requirements and legislation. Furthermore, the tool complies with materials declaration initiatives by EICTA (Europe), EIA (USA) and major system integrators such as Ericsson and Nokia
- 2 A study of product and process success stories shows that integrating eco-design into product development can contribute substantially to company profit. The benefits include reduced costs, increased market shares, increased staff commitment and improved innovation capabilities
- 3 Data on environmental costs and life cycle cost assessment (LCCA) play a growing role in the decision-making of electronic companies and in the management of their supply chains
- 4 GreenPack has encountered a strong turbulence in the EE industry with increasing globalisation, out-sourcing and short-sighted actions, and recurring re-organisations. In addition a majority of Nordic EE companies have downsized their operational environmental work due to weak customer demands and lack of European legislation. Despite this, GreenPack Academy activities gathered more than 150 companies from the Nordic countries as well as the Netherlands, Germany, USA, Korea and Japan
- 5 A big challenge for the EE industry is to prosper commercially from new market opportunities triggered by upcoming legislation. Top management has a crucial role in devoting resources to middle management. Experiences from the automotive industry, now facing the End of Life Vehicle (ELV) directive, show that it is important to act before a directive comes to force
- 6 GreenPack shows that there is widespread lack of awareness of commercial benefits of integrating ecodesign in product development at upper management in Nordic companies. This is serious as a shift towards a market favouring green products may come about fast. Moreover, there is an increasing gap between large companies and SMEs in terms of environmental awareness and competence
- 7 There is a demand for further work on materials declaration (concerning experiences and tools) and on increasing the awareness about new industrial and legislative developments and the commercial opportunities of going green. There is also a clear need to develop clearer guidelines and better methods for environmental cost accounting and allocation.

3 Background

The development in electronics has resulted in products with rapidly increasing functionality, lower weight and less volume. This was made possible by an increased use of advanced materials, components and processes and has given the users big advantages in the use phase.

With its complex composition, an increasing number of new applications, shorter product life, use of hazardous substances and lack of data on the material contents, electronic and electrical (EE) products constitute a threat to both man and the environment.

3.1 Challenges

EE manufacturers and their suppliers will face a number of important challenges in the near future affecting their business, among others

- The emerging EU directives on waste from electronic and electrical (EE) equipment, environmental impact of EE equipment and phase-out of hazardous substances
- An increasing need to know the materials contents of products in order to reduce the environmental impact and improve the recycling of used products
- A need to design and build products in an environmentally conscious and profitable way
- A need to build relations with other actors in the electronics eco-cycle
- And last but not least: New business opportunities for companies being proactive in the evolving changes

3.2 Nordic tradition

The Nordic electronics industry has a good tradition in carrying out joint applied research efforts. Projects have been carried out mainly on electronics packaging technologies but also on the environment. Some of the recent projects are:

The TRE Project (Technology for Clean Electronics) carried out from 1988 till 1991. This project aimed at developing and demonstrating reliable alternatives to freon (CFC) cleaning of electronic assemblies. The project contributed to Nordic countries becoming among the first in the world to phase out the use of CFCs for electronics cleaning.

The MQS Network with more than 100 participating companies aiming at improving the quality of printed wiring boards.

The Nordic Electronics Packaging Guideline, a web based decision support guideline to the use of high performance packaging such as Flip-Chip, polymer bonding, Chip Scale Packaging, Ball Grid Arrays and Multi Chip Modules

Nordic industry and research organisations also have a good name in heading sustainable development in many fields.

3.3 Designing the project

Facing the need of the Nordic electronics industry to meet the environmental demands and to prosper from the shift to green, a pre-study was carried out in 1998 with the aim of establishing a Nordic joint effort. The study comprised a critical review of previous national and Nordic projects, as well as a survey of the needs expressed by the industry.

The study showed that environmental maturity differed largely between the Nordic electronics manufacturers. A few large powerful companies were certified according to ISO 14001 and carried out structured work while the majority of companies had limited knowledge about environmentally conscious design and manufacturing, and about the business opportunities in the greening of business and products. The awareness about emerging national legislation and EU directives was also low.

Creating environmental awareness in industry and making the environment operational is not easy. Basically it's a question for the individual companies to decide to go for the environment and to organize themselves for this quest. So what could be done on a "systems level"?

By means of the pre-study, financed by the Nordic Industrial Fund, the GreenPack project was designed in co-operation with Nordic electronics companies. Phase 1 received a 5 MNOK grant from the Nordic Industrial Fund in May 1999. After a marketing and start-up phase the project officially started in February 2000.

GreenPack Phase 1 consists of three technical subprojects

- A Data flow
- B Guidelines
- C LCC (Life Cycle Cost Management)

and two subprojects supporting dissemination of results and the interaction with related initiatives

- D GreenPack Academy
- E Networking and marketing

The project was carried out with a strong adaptation to current needs and related activities on the international scene.

The aim of this report is to give an overview of the GreenPack project and the main results. Further information is available in the GreenPack Reports which are available at www.greenpack.org.

3.4 Objectives

The overall objective of GreenPack is

To make electronics companies adopt environmental skills in management and product development and benefit commercially from these skills

The objectives of Phase 1 were

To support the creation of materials data and the development of environmentally conscious and profitable products

To increase the awareness of the need for environmental actions and the business opportunities of going green

The target group of GreenPack is the actors in electronics supply chains, see Figure 1.

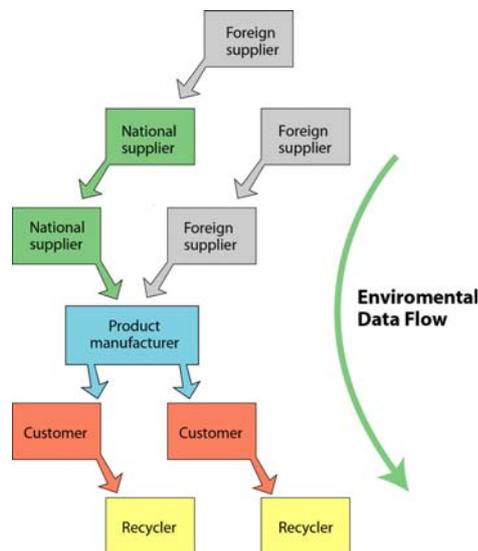


Figure 1 A main effort in GreenPack is to develop a flow of environmental data in the supply chains and by that create data for design data bases.

4 Results

4.1 Subproject A: Data Flow

4.1.1 Objective

The ambition was to meet the needs of member companies as well as supporting the development of an international industrial standard for materials declarations. Great efforts were made to create solutions supporting and being compatible with other initiatives such as the one by EICTA (European Information and Communications Technology Industry Association). Special efforts were made to allow for open materials declarations, a need pronounced by Nordic electronics companies.

The work in Phase 1 was limited to materials data, i.e. data on the content of the product as delivered. However, other data such as energy use and emissions in the individual processes of the supply chain have been considered in developing the tool, and for inclusion in the tool in the future.

The work was carried out in co-operation with a Working Group with participation from the following companies: ABB Substation Automation Oy, Aspocomp Oy, Elcoteq Network Corporation, Emerson Energy Systems AB, Flaga hf, Mascot Electronic AS, Siemens Mobil Phones A/S and Saab Ericsson Space AB.

Due to other initiatives on materials declaration, networking was an important part of the work (see section 3.5 for further information).

4.1.2 Results

The subproject has resulted in the *GreenPack Materials Declaration Tool*.

This is a prototype for a web-tool allowing for all actors along the supply chain to enter materials data about electronic products, components etc. It allows suppliers to report materials data in an easy way and provides these, on their part, an easy way to acquire data from their suppliers. Among other things, the tool includes guidelines for materials data flow management (see the factual square below).

Figure 2 shows an example of a declared component.

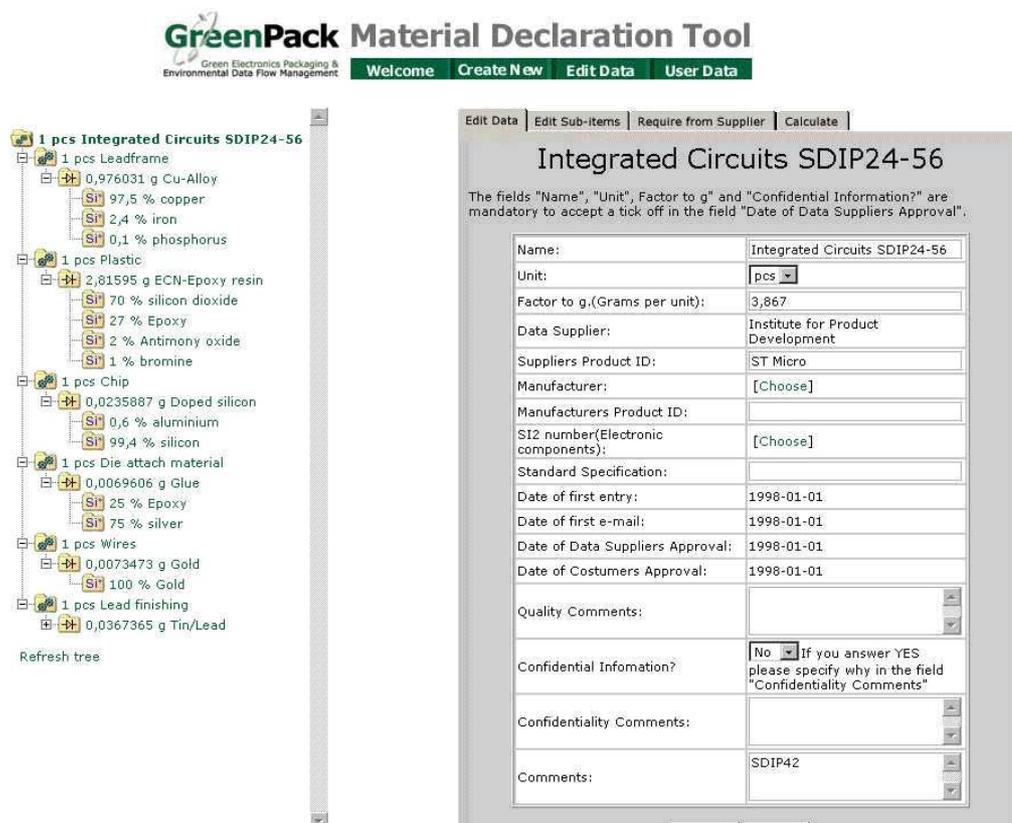


Figure 2 Example of a declared component from the GreenPack Materials Declaration Tool.

It has been the ambition to report the presence of any materials or substances present in concentrations above 0,1 %. For some substances it is, due to their environmental or toxicological properties, however, necessary to state their presence in even lower concentrations. These substances are listed in the “Declaration of absence / presence of certain substances”. The limit values for declaration in this list are based on similar lists (or drafts for lists) from EICTA, EIA, Ericsson, Emerson Energy Systems and Volvo. When the limit values are different from one list to the other the lowest limit value has been chosen. Materials data that have been collected during this work and that are not subject to any confidentiality claims are available as an integrated part of the web tool.

Case studies have been initiated by Mascot Electronic AS, ABB Substation Automation Oy and Tandberg asa. Due to a delay of the development of the web-tool the experiences from these case studies have been limited.

In addition to the development of the tool, a workshop on Materials Declaration for Electrical and Electronic Equipment was held (see section 4.4.2).

Facts about the GreenPack Materials Declaration Tool

With the tool you can

- Build a hierarchical model of an electronic product (in the same way as you organise directories and subdirectories on the hard disk of your PC)
- Automatically send e-mails to your suppliers requesting for material information. Requests can easily be forwarded up-streams in the supply chains by your suppliers
- Request materials content (full declaration) or absence/presence of specific substances on a predefined list
- Receive declarations by fax (in case you want a signed declaration)
- Calculate the materials content of a product

The tool contains

- Approximately 3300 chemical substances defined by CAS-numbers
- Approximately 300 materials
- Guidelines for materials data flow management including
 - Description of the data format and data structure
 - Benefits from material declaration for actors in the supply chain
 - Relevant legislation (present and future)
 - Complete manual to the Material Declaration Tool
 - List of problematic substances used in electrical and electronic equipment

The tool is available

- Free of cost on the web, and
- As a CD version (at cost price) which you can install on your internal system

For more information, please visit www.greenpack.org.

4.1.3 Resources

[Available at www.greenpack.org](http://www.greenpack.org)

Tool

- The GreenPack Materials Declaration Tool

Sub-reports

- A comparative review of the different material declaration initiatives
- List of 383 substances relevant to electronics and considered to be of specific concern by leading EEE companies

4.2 Subproject B: Guidelines

The aim of this subproject was originally to develop guidelines for design for the environment (DfE). However, during the course of the project it became clear that a large number of guidelines were being developed in various projects worldwide. Thus it was decided to make (i) an inventory of international activities on DfE and (ii) carry out a study demonstrating the link between environmentally conscious product development and economical benefits.

4.2.1 Results

Inventory

Since the GreenPack project was designed in 1998 several activities and projects have been carried out on design guidelines by institutes and companies within and outside the Nordic countries. New projects have also been started in this field which may meet some of the needs originally expressed.

The objective of this study was to present a basis for the decision on directions for further work within sub-project B. Guidelines of the GreenPack project. The study comprised an inventory of available Design for the Environment (DfE) guidelines for electronic and electrical equipment (EEE) and ongoing projects concerning such guidelines, as well as a survey of needs for support in the product development process as expressed by the GreenPack member companies. A selection of DfE tools was also assessed more closely.

The study showed that a large number of general guidelines are available on the market. However, only one or two have been found addressing specific products or functional families. Several guidelines cover implementation of environmental issues into management practices.

Study on economical benefits

The purpose of this study was to present economic incentives for companies to start working with ecodesign. The study covered 11 examples where

environmental concern and life cycle thinking has lead to commercial benefits. Nine of these examples concern products that can be classified as electrical or electronic products, though the environmental enhancement may not be directly related to the electronics of the product.

The success stories that were found in this study clearly show that integrating ecodesign into product development can clearly be beneficial for the company. The benefits found in these examples include

- reduced material, component and manufacturing costs
- increased market shares
- strengthened image
- increased staff commitment, involvement and satisfaction
- improved innovation capabilities
- increased competitiveness and profitability
- reduced inventory and administration costs
- reduced maintenance and service costs

All of these benefits give the companies staying power.

Successfully integrating ecodesign means considering environmental aspects in the strategic work and involving the management. Ecodesign integration must have management support, adequate resources allocated and ecodesign must become an integral part of the product development process and not something that is done beside it. Showing that competing companies or competing products have better environmental performance by conducting environmental benchmarking may get the management's attention.

Figure 3 shows one of the products in the study.



Figure 3 The Ecosys printer from Kyocera employs a drum coated with amorphous silicon. It provides 30 times the durability of conventional drums and more-or-less eliminates the need for drum replacement.

An important task is to analyse and present the benefits of integrating ecodesign. Which are the quantitative and qualitative benefits for the company and how much will it cost to get there? This analysis should present a basis for a decision on how much resources should be put into ecodesign. Environmental accounting can help management assess the business and environmental implications of different alternatives.

4.2.2 Resources

Available at www.greenpack.org

Reports

- DfE Guidelines - Inventory (*GreenPack Report 2000-01*)
- Green is the colour of money - Commercial success stories from eco-design (*GreenPack Report 2001-02*)

4.3 Subproject C: LCC

The objective of this subproject was to create an understanding of environmental cost management in the whole life cycle of products and its benefits in product development.

An introductory study was carried out in order to create an understanding of the life cycle cost assessment (LCCA) methodology for the electronics industry, as well as demonstrating its benefits and potential for product development in this industry.

A literature review on environmental accounting, environmental cost accounting and life-cycle cost assessment was done as a first step and then examples of company-specific approaches to environmental accounting in different industries were collected, assessed and reported. Furthermore results and conclusions of interviews with Nordic electronic companies on the importance and awareness of the LCCA approach were reported.

4.3.1 Results

The study showed that:

Data on environmental costs play a growing role in the decision-making of electronic companies and in the management of their supply chains.

Environmental accounting as well as environmental cost assessment is, however, still in its early development stage. Interests in the subject and emphases, contents and applications of accounting approaches vary essentially between companies and industries. The experiences are, however, of great value when planning practical approaches to and in solving problems related to environmental accounting practices.

LCCA is based on identifying, tracking and accounting environmental costs of the various life cycle stages of a product systematically. LCCA expands the accounting boundaries of a company to suppliers and consumers. An advanced management accounting system including environmental costs creates a basis for successful LCCA. As in LCA, life cycle costs can be assessed for different phases of the life cycle, and the cost assessment per product can be based on the calculation of cumulated life cycle based costs against an appropriate functional unit of the product.

Figure 4 describes schematically the differences between the life cycle and the life time (or span) of a product.

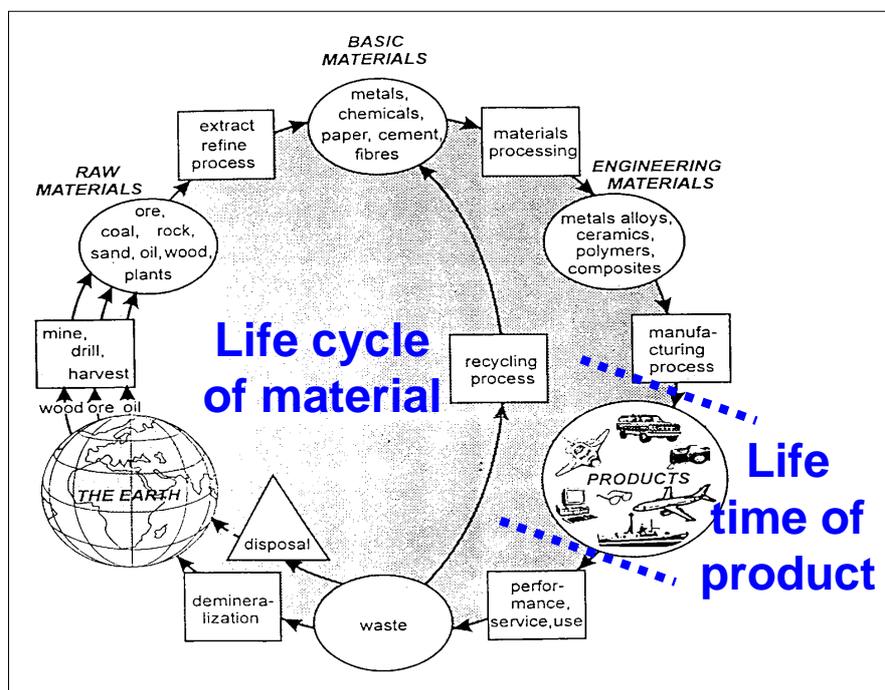


Figure 4 Differences between the life cycle and the life time (or span) of a product (Lindroos et al.).

Company interviews on environmental management accounting and related environmental cost assessment, reveal benefits and opportunities

- 1 in supporting the identification and prioritising of essential environmental improvement options
- 2 in achieving subsequent cost savings and productivity enhances in electronic product development
- 3 in supporting the internal and external communication of a company, and
- 4 in attaining subsequent competitive advantages for Nordic electronic industries on the global markets

4.3.2 Further needs

Based on the study done it can be concluded that there is a clear need to carry out a more detailed study on environmental accounting practices, as well as on cost accounting practices in electronic industry. In addition to having clear guidelines on how to keep track and records of, and how to account for company internal environmental costs, there is an obvious need for how to assess and allocate hidden environmental costs, as well as contingent costs. Case studies on cost accounting practices and LCC analyses of different electronic products are urgently needed in order to have more data for cost accounting guidelines and for understanding the commercial advantages of ecodesign.

Looking further into the future, that is beyond the present EU directives being prepared, it would be interesting to also assess external environmental costs related to the production and use of electronic products, that is costs that later will be imposed on companies in one or another form.

4.3.3 Resources

Available at www.greenpack.org

Report

- Life cycle cost assessment of electronic products - an introduction to the context and approaches (*GreenPack Report 2001-01*)

4.4 Subproject D: Academy

The GreenPack Academy served as a forum for transferring environmental skills and results from the project to the Nordic electronics industry.

Main activities within the Academy were

- Carrying out a Nordic Environmental Survey 2000 and 2002
- Carrying out workshops and seminars and a European conference
- Establishing and maintaining a website (www.greenpack.org)

In all seven workshops and courses were held in Oslo, Stockholm, Helsinki and Aalborg. Altogether 150 participants from 85 different Nordic companies took part in these activities.

4.4.1 Nordic Environmental Survey 2000 and 2002

The Nordic Environmental Survey was carried twice during the course of the project. The first time early autumn 2000 and the second time during the summer 2002. The survey was sent to about 500 companies (each time) in the electronics sector in the Nordic countries. The first time 80 companies responded to the survey, the second time 73 companies responded.

The surveys were carried out in order to better understand the environmental skills among Nordic electronic companies, and to look for improvements in their environmental skills during the project period.

The surveys show the following

- The share of companies who have an ISO 14001 or EMAS certificate, or have established their own management system, has increased from 40 % till 60 % since 2000
- Companies with more than 500 employees generally have much better environmental performance than companies with less than 200 employees. They are also better prepared to meet the upcoming directives. The gap between the global actors (>1000 employees) and small national companies (< 50 employees) has become bigger since the first survey
- The awareness of the upcoming WEEE directive among the Nordic electronics industry is high. 85% of the responding companies are aware of the directive
- The complexity of materials declaration for EE-products is unknown in the majority of the companies. There is no progress since the survey in 2002

4.4.2 Workshops and training

Workshop: Eco-design of electronic products (Stockholm 2000)

Eco-design is an increasing business concern for the electronics industry. Market demands force designers and manufacturers to integrate environmentally friendly ways of thinking into their product design processes and offer an opportunity to reduce costs and increase the competitive edge.

This workshop was targeted towards environmental and product development managers, as well as designer staff. The event provided an excellent opportunity to learn how to incorporate environmental considerations at the product design stage. The speakers from Technical University of Delft (The Netherlands), the Centre for Sustainable Design (UK) and Institute for Product Development (Denmark) presented «the cutting edge» in eco-design, gave practical examples and showed where and how to start on eco-design. Different strategies for large and small companies were presented.

Management seminar: Greening your business (Helsinki 2000)

The electronics industry worldwide faces a number of important environmental challenges affecting its business. Emerging EU directives on waste, hazardous substances and design, increasing demands from customers on environmental performance of products, and new business opportunities evolving from the inevitable greening of electronics are some of these challenges.

The target group for this seminar was management and those in charge of product development, and the idea was to give an idea of how to prepare for this transition.

Presentations were given by experts from Philips Consumer Electronics (The Netherlands), ICL (Belgium), Nokia (Finland) and Micro Analog Systems Oy (Finland).

Short-course: Eco-design of electronics for competitive advantage (Oslo 2001)

Eco-design is an increasing business concern for the electronics industry. Market demands force designers and manufacturers to integrate environmentally conscious ways of thinking into their product design processes and offer an opportunity to reduce costs and increase the competitive edge.

This two-day course was targeted towards designers of electronics and electrical equipment, as well as environmental and product development managers. Lecturer was Prof. Ab Stevels from the Technical University of Delft and environmental specialist at Philips Consumer Electronics (The Netherlands).

Workshop: Lead-free assembly & soldering of electronics (Aalborg and Helsinki 2001)

Removal of hazardous substances from the products is an increasing business concern for the electronics industry. Market demands force manufactures to look for alternatives to traditional tin-lead solder. The first lead-free products from Japanese companies were launched on the European market in 2001, and leading European companies now prepare for the shift to lead-free assembly technology for electronics.

Lecturer was Bob Willis from Electronic Presentation Services (UK). The programme was targeted towards manufactures of electronics and electrical equipment and their suppliers and customers. The workshop provided an excellent opportunity to get a status at lead-free technology worldwide, and learn when to make a shift to lead-free products. The workshop featured a practical guide to printed board assembly to allow alternative lead free materials to be introduced. Case studies of companies eliminating lead were presented along with the cost and environmental savings to be made. Examples of the types of equipment and modifications to the soldering process were also given.

Company specific training (2001)

One of the member companies was given a one-day company specific training for a large group of employees. The programme included the following topics

- Introduction to environmental challenges
- Driving forces
- Marketing of environmental performance
- Life-cycle approach

- Group work: Life-cycle assessment of a product
- The Eco-strategy Wheel with examples
- Discussion

The training was given by IVF.

Workshop: Materials declaration for electrical and electronic equipment (Oslo 2002)

Market requirements and upcoming legislation will force electrical and electronics companies worldwide to present material declarations for their products. While this first of all is a major challenge for the actors responsible for placing product on the market, every actor of the supply chain will be involved.

The Nordic GreenPack project has addressed this challenge as one of its main activities. As part of the work, the Materials Declaration Tool has been developed to support the exchange and flow of materials data through the entire supply chain.

The workshop gave a comprehensive view of state of the art and an opportunity to learn how to cope with materials declarations. The programme included presentations by IPU, SINTEF and IVF of tools, industrial experiences, information about recent developments and hands-on tool experience. One of the topics was the structure of materials data and confidentiality issues.

4.4.3 European conference: Improving the environmental performance in electronics supply chains (Oslo 2001)

Emerging EU directives on design, manufacturing and recycling of electrical and electronic equipment (EEE), national legislation and customer demands create a need for all companies in EEE supply chains to improve their environmental operation and performance. Manufacturers and suppliers must have the right methods, knowledge and approaches in order to benefit commercially from an emerging market.

This two-day conference covered

- International initiatives on materials declaration
- Commercial success stories
- Cost management
- Managing supply chains
- Eco-design New driving forces
- Environmental declaration
- Nordic approaches

Papers were presented by speakers from Europe, Japan and USA. The conference gathered 55 participants from Europe, USA and the far East. A special workshop on cost management was held together with the EU-project grEEEn. The conference was supported by the EUREKA network CARE Electronics.

4.4.4 The GreenPack web-site: www.greenpack.org

A web-site was developed for the project containing an area for member companies and a public area.

This internal area served as a file for all official documents and reports developed in the project. The site also contained a large number of links and documentation to relevant environmental work.

The results from the project are now available at the public area of www.greenpack.org.

4.4.5 Resources

[Available at www.greenpack.org](http://www.greenpack.org)

Reports

- Results from the Nordic Environmental Survey 2000 (*GreenPack Report 2000-02*)
- Results from the Nordic Environmental Survey 2002 (*GreenPack Report 2002-01*)

Proceedings

- Proceedings from GreenPack conference November 2001
- Proceedings from materials declaration workshop April 2002

4.5 Subproject E: Networking and marketing

The objective of this subproject was to create a synergy with other research initiatives and to keep up-dated on the development taking place internationally on electronics and the environment. Within this subproject GreenPack was also marketed towards industry in order to create the member stock.

4.5.1 Activities

This subproject mainly aimed at supporting the technical work on Data Flow (subproject A) in order to promote the GreenPack work on materials declaration, to promote compatibility with international initiatives and to learn about recent developments. A number of meetings and discussions were held with EIA (Electronic Industries Alliance, USA), EICTA (European Information and Communications Technology Industry Association), JEITA (Japan Electronics and Information Technology Industries Association) and ZVEI (Zentralverband Elektrotechnik- und Elektronikindustrie, Germany).

The discussions showed that the Nordic electronics industry wants open materials declarations (where all materials in a product over certain threshold values are declared) compared to more conservative approaches where the occurrence of materials are given according to common lists. Open materials declarations allow companies to meet requirements in the future on materials contents in products (which probably will be more severe than today due to increasing knowledge about the effect of substances on the environment and human beings), without needing to re-question their suppliers.

A formal co-operation was carried out with the EU project “grEEEn: Cost Management System for Greening Electrical and Electronic Equipment”. GreenPack and grEEEn co-arranged a cost management workshop at the GreenPack conference in Oslo. In addition an exchange of reports was carried out.

The marketing effort resulted in a member group of 22 companies representing suppliers, contract manufacturers, product manufacturers, telecom operators in Denmark, Finland, Iceland, Norway and Sweden.

Meetings were also held with other projects such as the AEOLOS project (An End-of-Life of Product Systems).

Figure 5 shows main actors in the external network of GreenPack.

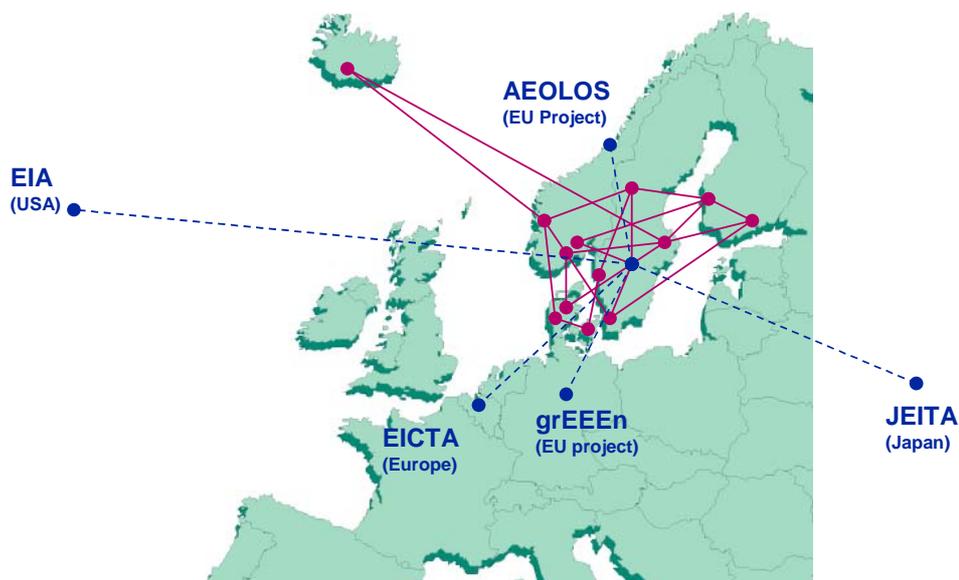


Figure 5 Main actors in the GreenPack external network.

GreenPack applied for and received EUREKA status in January 2001(E!2523).

The paper “GreenPack - The Nordic model for achieving first class environmental performance in electronics supply chains” was presented at the Electronics Goes Green 2000+ conference in Berlin 11-13 September 2000.

In addition information about the progress in GreenPack has been presented for industrial organisations such as the KOTEL group in Finland.

5 Game-plan change

Since GreenPack was redefined in the autumn of 1998 there have been extensive changes in the ambience of the project, which should be considered when the outcome of GreenPack Phase 1 is judged. The changes, among other things, mean that

- The large systems integrators have strongly focused on core activities and out-sourcing, with the consequence that the environmental work has been distributed among the suppliers
- Ever more short-perspective demands for profitability, increased, international competition, and small profit margins (with scant internal funds as a result) are putting Nordic electronics manufacturers in a situation where most find it difficult to conduct, on their own, the necessary environmental work
- Legislation and environmental customer demands are relatively weak driving forces and the awareness of profitability, along with environmental adaptation of products, and production needs to be kept under observation at executive levels of the enterprises.

5.1 Globalization and out-sourcing

Business activity at large systems integrators of electronics during the last two years has undergone big changes. Among them there is above all a focusing on core activity and out-sourcing. This turn of events means that

- National consideration need not to be taken in the choice of suppliers - manufacturing and components are purchased where you get the best prices and functions, including environmental efficacy
- Contract suppliers often have owners with short-sighted demands for returns and profitability
- The operative environmental work is distributed among suppliers and the large actors no longer are instrumental in environmental work. This increases the importance of well-functioning supplier chains with many small- to average size enterprises (who are in the focus of GreenPack).

An ever recurrent question in the selling of GreenPack has been whether Ericsson or Nokia participate in the project. Lesser enterprises still nourish the idea that it

is right and proper to join a project if Ericsson and Nokia are in it. This is a view that no longer mirrors reality.

To this should be added that environmental work at the large systems implementers has been “centralized”, so that their separate enterprises no longer independently take part in external projects and activities but rather, through central coordination, by means of internal networks.

5.2 Turbulence in the electronics field

The field, today, is characterized by strong turbulence in regard to acquisitions, reorganizations, technical development, and market demands on deliveries and product quality. In this situation, the operative environmental work is taking a back seat at many enterprises.

5.3 Motive forces at an EU level are lagging behind

When GreenPack was defined in the summer and autumn of 1998, a proposal for an EU directive about electrical and electronic waste had recently been put forth. The proposal, at that time, was a plain motive force on the industry and a motor for the project. After the proposal was published, it has been revised countless times to its contents and start point and has been complemented with other proposed directives.

The proposed directives today constitute a threat to the industry but most enterprises take a wait-and-see attitude. Environmental customer demands today are experienced by many enterprises as weak or nonexistent.

6 Future needs and ideas for continued work

GreenPack Phase 1 has been carried during a period with no environmental legislative pressure on EE products in terms of EU directives. National producer responsibility schemes have come in force, e.g. in Norway and Sweden. However, creating little pressure on product development. The next few years will see a large number of legislative actions and decisions as well as industrial initiatives.

Discussions in the GreenPack Steering Group and with other actors show that the next activity in GreenPack (Phase 2) should be an industrial network with two objectives

- Supporting implementation of materials declarations
- Tracking developments the world around, supporting companies in taking the right environmental actions with right timing

The materials declaration activity would encompass further tool development, exchange of experiences from materials declaration and an information exchange with international initiatives.

Concerning environmental cost accounting and allocation, there is a clear need not only to continue with awareness raising efforts and education programmes, but also to develop clearer guidelines and better methods for environmental cost accounting and allocation. Concrete case studies on different types of electronic product chains would be one step on the way forward.

Please visit www.greenpack.org if you would like to share your points of view or join a continued work in GreenPack.

7 Abbreviations and links

AEOLOS	EU project: An End-of-Life of Product Systems (www.aeolos.org)
EE	Electrical and electronic
EEE	Electrical and electronic equipment
EIA	Electronic Industries Alliance, USA (www.eia.org)
EICTA	European Information and Communications Technology Industry Association (www.eicta.org)
EUREKA	Pan-European network for market-oriented, industrial R&D (www.eureka.be)
grEEEn	EU project: Cost Management System for Greening Electrical and Electronic Equipment (www.green.it)
JEITA	Japan Electronics and Information Technology Industries Association (www.jeita.or.jp)
LCC	Life cycle cost
LCCA	Life cycle cost assessment
MQS	A Nordic network encouraging printed circuit board development (www.mqsnetwork.org)
NOK	Norwegian Kroner
Nordic countries	Denmark, Finland, Iceland, Norway and Sweden
ZVEI	Zentralverband Elektrotechnik- und Elektronikindustrie, Germany (www.zvei.de)

Appendix 1 Member companies

Companies forming the Steering Group.

ABB Substation Automation Oy	Finland
Aspocomp Oy	Finland
Autoliv Electronics AB	Sweden
Brüel & Kjær S&V A/S*	Denmark
DeLaval International AB	Sweden
Elcoteq Oy	Finland
Eltel Fire & Safety AS*	Norway
Emerson Energy Systems AB	Sweden
Flaga hf	Iceland
Flextronics International Denmark A/S*	Denmark
Swedish Defence Administration (FMV)	Sweden
Kitron Development AS	Norway
Mascot Electronic AS	Norway
Saab AB (group)	Sweden
Siemens Mobile Phones A/S	Denmark
Skanova	Sweden
Sonera Ltd	Finland
Tandberg Telecom AS	Norway
TCO Utveckling AB	Sweden
Telenor Bedrift AS	Norway
Tomra Systems ASA	Norway
Trienta Elektronik AB*	Sweden

* Companies participating only the first year.