MILJØMINISTERIET

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Guidelines for the Inclusion of Environmental Aspects in Product Standards

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Foreword

The aim of this manual is to provide those working with standardisation with a tool to include environmental aspects in product standardisation. The manual's target group is specialists in product standardisation that in their daily work are not occupied with product related environmental issues.

The manual is a résumé of a corresponding manual in Danish compiled by Rambøll, The Danish Technological Institute and The Danish Standards Association with economic assistance from the Danish Environmental Protection Agency.

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1 Preface

1.1 Objective

The objective of this manual is to give those working with product standardisation practical advise and instruction on how to include environmental aspects in product standards. The aim is thus to contribute to the integration of technical standards and environmental consideration in the process of product standardisation.

1.2 Background

Product standards influence a product’s environmental impact as standards often establish requirements for a product’s design, content and mode of operation. Even though product standards are primarily aimed at a single phase in a product’s life cycle, viz. production, they influence other phases in the life cycle and, therefore, also the environmental impact of a product in these phases.

Product standards can, therefore, be a useful instrument in preventing and reducing the environmental impact of products during their life cycle.

The major standardisation organisations such as CEN and ISO have already taken steps to include environmental considerations in their standards, such as:

- ISO Guide 64: 1997 (DS/INF 118:1997) (a general instruction on how to tackle environmental issues in connection with product standards)
- CEN Environmental Guidelines (CEN’s general framework for the inclusion of environmental aspects in standards)
- CEN Environmental Help Desk (CEN’s office for assisting standardisation committees with environmental questions)
- ISO standards for environmental management (ISO 14000 series, which includes a number of standards aimed at companies’ environmental management systems).

It has to be stated that there is a long way to go before environmental aspects are as well integrated in product standardisation as in other fields. There is an urgent need for the inclusion of environmental aspects in product standards. This manual intends to address this issue.

1.3 Scope and Definitions

This manual concerns product standards i.e. standards that set technical requirements to products such as the content of substances and materials, strength, production methods etc. The manual will, to a lesser extent, also include methodology, test and management standards.

The manual is not a summary of the Environmental Management Standards, ISO 14000 series, even though the principles in the ISO 14000 series will be used when undertaking environmental assessments of products.

The manual uses examples from the four product standards named in Fig. 1.1 below.

Figure 1.1: The four product standards used as examples in this manual

- Concrete (EN 206-1 Concrete – Part 1: Specifications, properties, production and conformity)
- Masonry (Eurocode 6: Design of Masonry Structures, including amongst others prEN 771 Specifications for masonry units)
- Building materials (Thermal insulating materials CEN/TC 88, Ad hoc Group on Environment)
- Metal (EN ISO 12944-5 Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems)

The manual is primarily aimed at standardisation according to the CEN framework, but can in principle also be used in standardisation work with other frameworks such as ISO as all the major global, regional and most national standards associations have expressed an interest in including environmental aspects in their standards.

1.4 Target Group

The manual's target group is specialists working with the standardisation of products, but who do not work with environmental aspects daily.

Employers of manufacturing companies, industrial associations, consumer associations, research institutes and consultancy firms are the primary specialists in standardisation and are, therefore, the primary target group of this manual.

Others who need a system for the environmental assessment of products can also use this manual.

1.5 Scope and Definitions

The manual is structured in the following way:
- Chapter 2 describes the interaction between product standards and environment and the role product development and standards have in this interplay. CEN's environmental checklist is also introduced as an instrument for undertaking an initial screening of a product's environmental impact.
- Chapter 3 gives an overview of how a product's principle environmental aspects can be identified, which will allow for the drawing up of a strategy to incorporate these aspects in production.
- Chapter 4 provides ideas for the reduction of the environmental impact of a product during manufacture.
- Annex 1 includes a glossary of terms, whilst annex 2 is a list of references.

2 Correlation between Product Standards and Environment

Product standards determine requirements for the manufacture, content and mode of operation of products. As all manufactured goods influence the environment in one way or another, product standards can influence the environmental impact of a product.

The great variety of products manufactured by modern industry and the huge numbers in which these goods are produced means that the products – and thereby also the product standards – influence the environment.

Even though a product standard may only apply to a single aspect in the product's life cycle e.g. its dimensions or the use of certain materials, this has an influence on the product's entire life cycle from the extraction of raw materials to the disposal or release of the product to the environment. Some of the influences a product standard can have on the life cycle of a product are mentioned in Fig. 2.1 below.

It is important to analyse a product through its entire life cycle when determining environmental requirements in a product standard.

Figure 2.1: Examples of the environmental impact of product standards

- Standards for thermal insulating materials:

When a standard sets requirements for an insulating material's insulating properties it will have an effect on the materials which can be used, the amount of different materials that can be used and the method of production. In this way the standard influences the extraction of raw materials and the production phase, as well as the environmental problems that may arise in connection with these processes. The standard will also have an influence on the amount of energy saved due to the use of the isolating material in a building during the application phase.

- Standards for concrete:

When a standard for concrete allows for the use of flue ash and other reclaimed materials it plays a role in solving the problem of depositing these residues. If the flue ash contains environmentally hazardous materials in large amounts e.g. heavy metals, one should be aware of the fact that leaching of the hazardous materials in the application phase or depositing phase can lead to environmental problems.

This chapter gives a short introduction to CEN's environmental checklist, which is CEN's method for undertaking an initial analysis of a product's environmental impact. After this an introduction is given to a more detailed life cycle assessment of a product. This is followed by concrete examples of life cycle assessment.

2.1 CEN's environmental checklist

CEN has developed an environmental checklist for use in work with product standards. The checklist is based on the principles of Life Cycle Assessments (LCA). The objective of the environmental checklist is to create a comprehensive overview of a product's impact on the environment throughout its entire life cycle. CEN's environmental checklist is a "screening tool" that highlights the most important environmental impacts in a product's life cycle, thereby focusing on the environmental aspects that should be taken into account when determining a product standard. It is compulsory for standardising bodies to use the environmental checklist when developing new standards and revising old standards.

The environmental checklist is shown in Fig. 2.2 below. The main phases in a product's life cycle (production, distribution, application and deposition) extend from the one axis, whilst environmental issues extend from the other axis. Apart from the immediate environmental parameters (discharge to the atmosphere, discharge to water, refuse, noise, migration of substances and soil pollution) other environmental aspects are also considered such as use of resources (resource and energy consumption) and accidents.

The environmental checklist is used by marking the fields where the individual environmental parameters are relevant e.g. with crosses or yes/no. The distribution of the number of crosses or yes/no will give an indication of where the most important environmental problems occur.

It may happen that a product gets crosses in many or all of the fields. In such situations it is necessary to prioritise according to criteria determining the importance of each environmental aspect in order to reduce the number of crosses.

It is often the case that the technical experts sitting on standardisation committees know the product and method of manufacture so well that they can complete such an environmental checklist immediately. In cases of uncertainty or disagreement the completion of the checklist should be done after consultation. If necessary life cycle assessments can be made in varying detail to reach an outcome. CEN Environmental Helpdesk can also provide assistance as can CEN's homepage.

The checklist can be expanded to include, amongst others, working environment and indoor climate. The individual life cycle phases can also be divided up into sub-phases if required.

Fig. 2.3 below provides an example of CEN's environmental checklist completed by an environmental ad hoc group under CEN Technical Committee 88 on thermal insulating materials. The objective of the ad hoc committee's work was to complete initial considerations of the environmental aspects associated with thermal insulating materials. CEN TC 88 could then concentrate on the environmental issues that should be incorporated into the revision of the standards under the jurisdiction of TC 88. The environmental ad hoc group decided to limit the completion of the checklist to mineral wool products.

Figure 2.2: CEN's Environmental checklist

Environmental aspects	LCA-phases				
	Production of raw materials	Production	Distribution	Application	Deposition
Use of resources					
Energy consumption					
Discharge to the atmosphere					
Discharge to water					
Refuse					
Noise					
Migration of substances					
Soil pollution					
Accidents					

The ad hoc group marked the fields in the checklist with a "yes" where it was felt that there were important environmental impacts and "no" where it was felt that the environmental aspects were not substantial and, therefore, should not be included in further considerations.

As indicated on the checklist, the ad hoc group determined that the most important environmental impacts connected with thermal insulating materials are linked to energy consumption and discharge to the atmosphere. It is especially the manufacturing and deposition phases that have the most serious environmental impacts. It is not evident from the checklist that some of the environmental effects of the products are positive e.g. the products have a large energy saving and noise reducing effect in the application phase (2.D and 6.D), which give a positive environmental impact.

The environmental ad hoc group compiled a more detailed report, which explains the decision behind each marked field.

Figure 2.3: Example of a checklist for a product (mineral wool products for thermal insulation prepared by TC 88 ad hoc committee for environmental issues)

	A. Pre-production including transport of the raw materials	B. Production	C. Distribution and installation (including packaging)	D. Use	E. End of life
1. Natural resource use	Yes	Yes	No	No	Yes
2. Energy consumption	Yes	Yes	Yes	Yes	Yes
3. Emissions to air	Yes	Yes	Yes	Yes	Yes
4. Emissions to water	Yes	Yes	No	No	Yes
5. Waste	Yes	Yes	Yes	No	Yes
6. Noise: nuisance	No	No	Yes	Yes	No
7. Effect on soil (land use)	Yes	Yes	Yes	No	Yes
8. Risks from accident or misuse	Yes	Yes	No	No	No

2.2 How to make a life cycle assessment

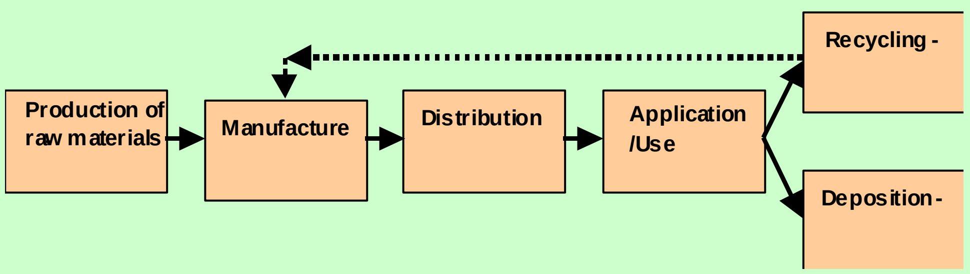
The concept of life cycles is central to the environmental assessment of products. Due to this most international standardising bodies have accepted life cycle assessments as a general principle in environmental assessments in connection with product standardisation. A short introduction to the principles of life cycle assessments as well as a few examples follows.

A product's life cycle is typically divided into the following phases:

- Production of raw materials
- Manufacture
- Distribution
- Application/use
- Recycling
- Deposition.

A product's principle life cycle is illustrated in Fig. 2.4 below.

Figure 2.4: The principle steps in a product's life cycle



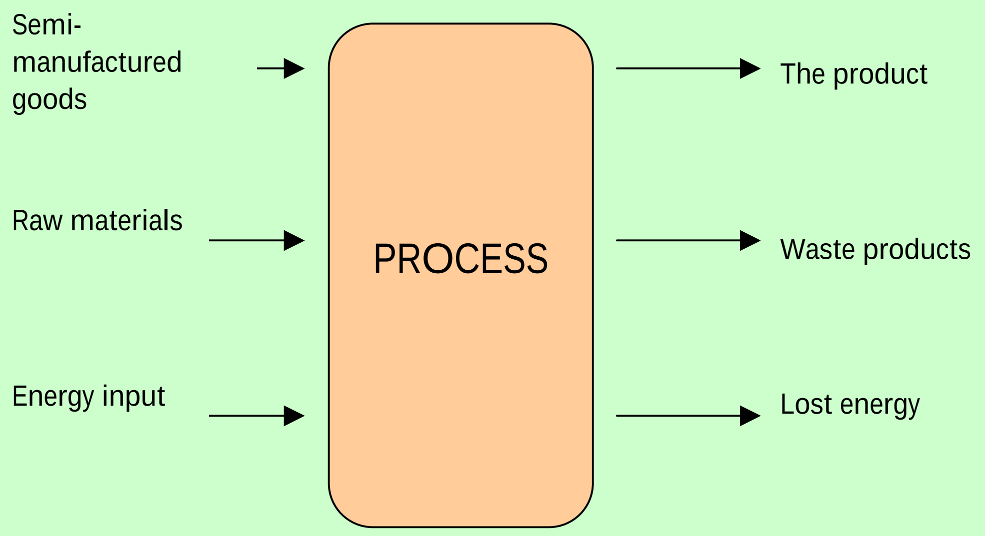
In reality a product's life cycle is much more complicated than the above mentioned seven phases. There can be many more links in the life cycle as well as many "off shoots" as semi-manufactured goods are assembled to form one complex product. Due to this transportation often occurs between the various phases, which can be relevant for the overall environmental assessment. Various forms of recycling can also mean that residual products are returned to the life cycle.

All the individual phases can, in principle, be considered as input/output processes where raw materials or semi-manufactured goods enter at the one end and new products and waste products emerge from the other end. All processes require the input of energy and there will, therefore, always be energy that goes to waste in one way or another, which should be considered in the overall assessment. The input/output model is illustrated in Fig. 2.5 below.

Inputs and outputs can have very different characteristics. An input can, for example, include both raw materials such as water and clay as well as energy in the form of electricity. Outputs can, therefore, include waste materials as well as wasted energy. The product can be either a semi-manufactured good or the final product depending on where in the life cycle the product occurs. Waste products can be either solid waste, emissions to the atmosphere such as smoke or wastewater. Wasted energy is the energy that is made available during a phase of production but which is not used in the process. This could be residual heat for example, which could be used for central heating instead.

If the "process" is the sandblasting of a steel mast, which will later be painted then the semi-manufactured product is the steel mast, the raw material is the sand used in the sandblasting and the energy is the electricity used to blast the sand against the mast. On the output side the product (which is still only semi-manufactured) is the sandblasted steel mast. The waste product is the contaminated sandblasting sand, which can be clean and reused. The waste energy is the heat released from the sandblaster.

Figure 2.5: Input-output model for a process in a products life cycle



Over and above the more traditional material and energy flows other environmental impacts may have to be analysed. Effects such as noise, impact on biodiversity and others are more difficult to analyse, but in some cases these impacts may be the most important so one should be careful not to narrow an environmental assessment down to much from the start.

If one of the products being considered is, for example, made of lumber from tropical rainforests one of the most important environmental aspects may be the loss of biodiversity in the forest from which the lumber originates, while other environmental parameters such as toxic emissions may be of lesser consequence.

Perpetual substances such as heavy metals once released, in principle, circulate infinitely in the environment. During their course in the environment they are taken up by organisms (plants, animals, humans) and thereby have a negative effect. As one cannot follow a substance in the environment through all eternity it is necessary to limit how far one will follow a product's environmental impact in an environmental assessment.

The environmental impact of an output is determined by a number of different conditions, such as:

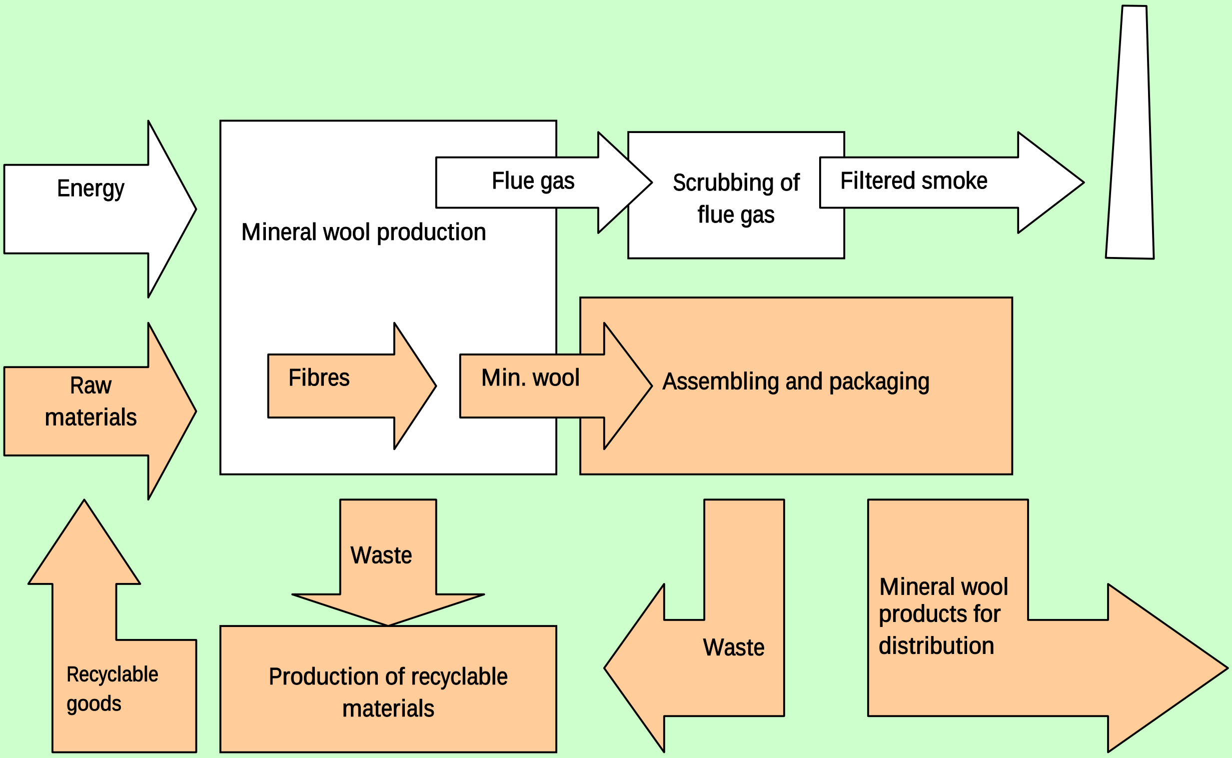
- How much is discharged (amount)
- How long and when do discharges occur (time/season)
- Where substances are discharged and how they are spread (place)
- What is the recipient environment (recipient).

Some environmentally damaging substances occur in natural cycles, such as CO_2. The environmental impact is due to disturbing the natural balance of the cycle (e.g. greenhouse effect). Other products are manmade e.g. pesticides, and if these are persistent they will impact on the environment and its organisms at many levels and over a long period of time.

2.3 Examples of analyses of environmental impacts

In Fig. 2.6 below an example of a simplified flow diagram for a mineral wool product's journey through the manufacturing process, including the recycling of waste products. After distribution, the completed product will generally be used in the building sector where it will remain for many years. There is usually a certain amount of wastage during the application/use phase, which can be deposited, sent to waste disposal or returned to the factory for recycling. After use the product is generally sent to waste disposal or returned to the factory as recyclable waste.

Figure 2.6: Example of a simplified flow diagram for mineral wool in a mineral wool factory



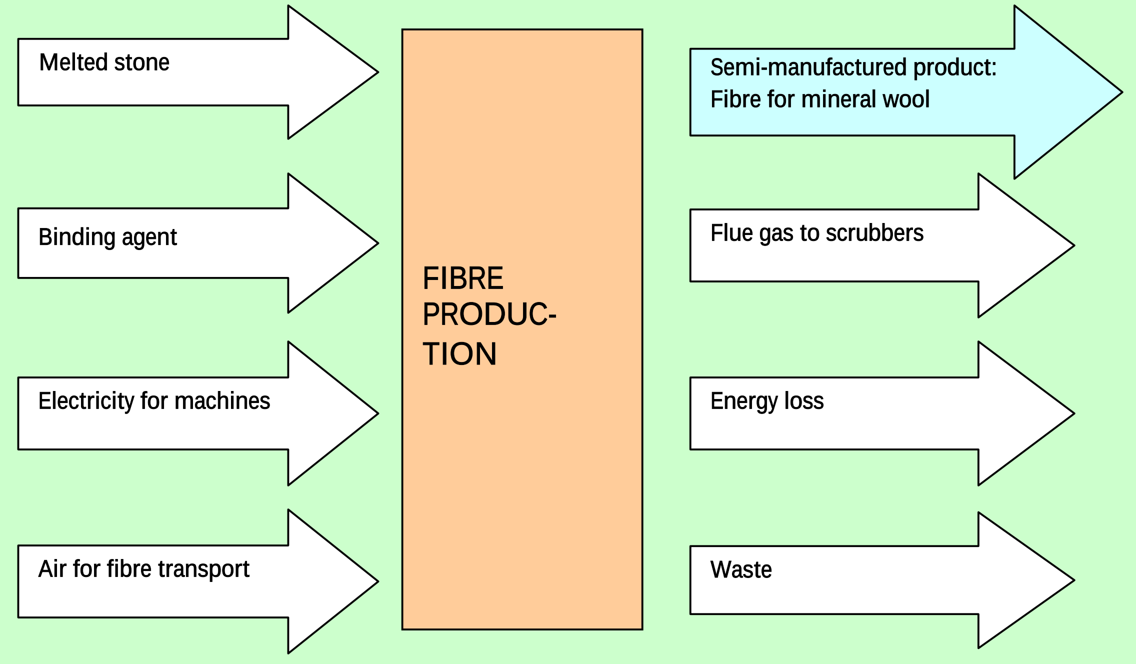
The aim of producing a flow diagram of the relevant product is to create a comprehensive overview of which processes the product is subject to as well as which inputs and outputs are applicable for the various processes.

Using the principle of "what is put in must come out again" will give a control mechanism to ensure all inputs and outputs are accounted for. If something is not accounted for then it is necessary to investigate further to find the cause of the problem. Depending on the delimitations of the problem it may be necessary to analyse the steps before and after the relevant process in order to form an overview of a greater part of the life cycle.

Using a flow diagram also helps create a picture of which outputs are released to the environment, and thereby the material and energy flows that influences the environment. Furthermore flow diagrams are useful when limiting the scale of a life cycle assessment where many material and energy flows have to be taken into account. Flow diagrams also make it easier to determine where environmentally hazardous substances are in the production process and how they are handled.

In Fig. 2.7 below a more detailed input/output model of the central process in Fig. 2.6, viz. the manufacture of mineral wool is shown. Such a description allows for an in depth analysis of inputs and outputs according to the principle of “what goes in must come out again”.

Figure 2.7: Example of a simplified input/output model for the manufacture of mineral wool



When working in environmental aspects it is the outputs that occur directly to the environment and the inputs that originate from natural resources that are of the greatest interest.

For many construction products such as mineral wool, the application phase is relatively simple as the products are enclosed in the building and carry out their intended function, viz. thermal insulation. Other building materials require regular cleaning and maintenance and will, therefore, have a number of inputs and outputs associated with their application phase. If the environmental analysis includes the entire building then mineral wool insulates the structure and thereby plays a role in reducing energy consumption in the building. This will in turn play a role in reducing the environmental impact (inputs and outputs) related to energy consumption of the building. When looking only at the environmental impacts of mineral wool it is in the manufacturing and deposition phases that lead to the greatest environmental impacts.

For other products e.g. washing machines and cars a different pattern forms. For these products it is the application phase that has the most important inputs and outputs that impact on the environment. For cars it is especially exhaust gases that cause the greatest environmental impact. For washing machines it is inputs such as water, electricity and soap powder that directly and indirectly pose the greatest environmental problems. The discharge of wastewater on the output side also creates a considerable negative environmental impact. Even though there are important inputs and outputs, and therefore also environmental impacts, during the production of the above mentioned products these are overshadowed by those that take place during the application phase.

3 Tools for Assessing the Environment

For many years environmental management focused on reducing environmental impacts from production e.g. setting limits for discharges of wastewater from industry as well as the introduction of cleaner technology. During the 1990'ies the focus has shifted to the products in a product-oriented strategy. Some of the topics discussed and developed in product-oriented strategies are:

- The development of methodologies for the environmental assessment of products, amongst others life cycle assessments (LCA)
- Environmental labelling and methodologies for this
- Environmental declaration of contents and methodologies for this.

All of these are important tools for making products more environmentally friendly and can, therefore, also be useful when including environmental aspects in product standards.

This chapter starts by introducing product-oriented environmental strategy followed by a discussion of the tools used for life cycle assessments (LCA), environmental labelling and environmental declaration of products.

3.1 Product-oriented environmental strategy

Traditionally preventative environmental measures have been concentrated on production processes in industry by regulating discharges from companies and introducing cleaner technology.

Lately, the focus has shifted to product-oriented environmental strategies. In other words working on reducing the environmental impact of the product throughout its entire life cycle from the extraction of raw materials to deposition of the product.

The EU Commission presented a green paper in 2001 on Integrated Product Policy (IPP). The green paper was discussed in the EU parliament, the Council of Ministers and interested and affected parties, which resulted in a white paper being published in 2002. The white paper established the UE Commission's strategy on the subject (Communication from the Commission to the Council and the European Parliament: "Integrated Product Policy – Building on Environmental Life-Cycle Thinking" COM (2003) 302 final).

The strategy is built on the following five key principles:

- Promotion of life-cycle thinking
- Working with the market
- Stakeholder involvement
- Continuous improvement of products' environmental performance
- Use of a variety of policy instruments.

The strategy will be implemented through the establishment of a framework for the continuous environmental improvement of products, which includes:

- The use of taxes and subsidies to promote the production of environmentally friendly products
- Voluntary agreements and standardisations
- The integration of environmental aspects into the European standardisation process
- The greening of public procurement policy
- Making life-cycle information and interpretative tools available
- Ensure the inclusion of IPP in environmental management systems (EMAS etc.)
- Product design obligations
- Promote consumer information on environmentally friendly products, including environmental labelling etc.

3.2 Methodologies for life cycle assessments

Life Cycle Assessments (LCA) are an important element in product-oriented environmental work and in the IPP as LCA is a tool for determining the environmental impacts of a product and thus identifying ways to reduce these. LCA can also be used to develop eco-labels and environmental declarations of products, and thereby help the consumer make a more environmentally informed choice of product.

Many initiatives have been taken to clarify LCA:

- ISO has published a series of standards on how LCA should be carried out
- CEN has developed an environmental checklist for standards
- Many countries, organisations and companies have developed computer-based tools to carry out LCA's
- Danish Building and Urban Research Institute has developed a computer-based tool for environmental assessment tool for building and construction materials, building parts and buildings (BEAT).

The individual methodologies are discussed briefly in the following sections.

3.2.1 ISO's LCA-standards

During the 1990'ies ISO approved a series of environmental standards viz. the ISO 14000 series. A section of the standards include a description of how LCA's should be carried out. This sub-section was developed from 1997 – 2000 and makes up the ISO 14040 series.

The series consists of the following four standards: Life Cycle Assessments

- ISO 14040 Life Cycle Assessments - Goal and scope
- ISO 14041 Life Cycle Assessments - Life Cycle Inventory Analysis
- ISO 14042 Life Cycle Assessments - Life Cycle Impact Assessment
- ISO 14043 Life Cycle Assessments - Life Cycle Interpretation

ISO 14040 gives instructions on how to define the aim and scope of a LCA in order to clearly define the objective of the LCA and which products and aspects it encompasses. The standard also gives a step-by-step account of what a LCA should include.

ISO 14041 gives guidelines on how to carry out an inventory of a products life cycle with inputs and outputs etc.

ISO 14042 provides guidelines for determining environmental impacts of the relevant inputs and outputs.

ISO 14043 gives instructions on how the results of the inventory and the determination of the impacts should be interpreted and how quality controls should be carried out.

ISO 14048 encompasses the format of data compilation and exchange of data.

Fig. 3.1 below shows an updated list of standards within the ISO 14000 series.

ISO have since published ISO Guide 64 (DS/INF 118:1997), which contains a description of the connection between product standards, product development and a product’s environmental impact during their entire life cycle.

Figure 3.1 Final Adopted International Standard in the ISO 14000 Family

ISO 14001 Environmental Management Systems - Specification with Guidance for Use
ISO 14004 Environmental Management Systems - General Guidelines on Principles, Systems and Supporting Techniques
ISO 14010 Guidelines for Environmental Auditing - General Principles on Environmental Auditing*
ISO 14011 Guidelines for Environmental Auditing - Audit Procedures - Auditing of Environmental Management Systems*
ISO 14012 Guidelines for Environmental Auditing - Qualification Criteria for Environmental Auditors*
ISO 14015 Environmental management - Environmental assessment of sites and organizations (EASO)
ISO 14020 Environmental labels and declarations - Goals and Principles
ISO 14021 Environmental Labels and Declarations - Self-Declaration Environmental Claims - Terms and Definitions
ISO 14024 Environmental Labels and Declarations - Type 1 - Guiding Principles and Procedures
ISO/TR 14025 Environmental labels and declarations - Type III environmental declarations (technical report)
ISO 14031 Environmental Management - Environmental Performance Evaluation - Guidelines
ISO 14032 Environmental Management - Environmental Performance Evaluation- Case Studies Illustrating the Use of ISO 14031 Technical Report
ISO 14040 Environmental Management - Life Cycle Assessment - Principles and Framework
ISO 14041 Environmental Management - Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis
ISO 14042 Environmental Management - Life Cycle Assessment - Impact Assessment
ISO 14043 Environmental Management - Life Cycle Assessment - Interpretation
ISO 14048 Environmental Management - Life Cycle Assessment - Life Cycle assessment data documentation format
ISO 14049 Environmental Management - Life Cycle Assessment - Examples of Application of ISO 14041 to Goal and Scope Definition and Inventory Analysis Technical Report
ISO 14050 Terms and Definitions - Guide on the Principles for Terminology Work
ISO 14061 Information to Assist Forestry Organizations in the Use of Environmental Management System Standards ISO 14001 and ISO 14004 Technical Report

Note: * It should be noted that a new standard, ISO 19011 (ISO 19011Guidelines on quality and environmental management systems auditing), is in development and once adopted, will replace ISO 14010, ISO 14011, and ISO 14012. It is anticipated that ISO 19011 will be a final standard by 2001.

3.2.2 Computer-based LCA Tools

During the 1990'ies a number of countries, including Denmark and the Netherlands, developed computer-based LCA methodologies for determining a product's or activity's impact on the environment during its entire life cycle. The Danish system is called Environmental Development of Industrial Products (EDIP).

Whilst CEN's environmental checklist is a screening methodology the computer-based LCA methodologies can give very detailed information on a product's environmental impact. This is, however, dependant on the data input the computer programme it is fed with.

The LCA tools currently available require a great deal of training of the user, but there are currently new, user-friendlier tools under development.

3.2.3 Environmental Indicators

Environmental indicators are used in order to measure a company's or an activity's environmental performance. Environmental indicators are central environmental parameters that are associated with a certain activity e.g. an indicator can be the discharge (in kg per year) of an environmentally hazardous substance during production. By following the development of an environmental indicator, such as the amount of hazardous substance discharged (in kg per year), and comparing this with the production process, such as the number of units manufactured, one can determine whether the environmental performance of a production process (in kg per product) is improving or becoming worse.

ISO 14031 and 14032 gives guidelines on how to construct a system that can determine a company's environmental performance.

3.2.4 BEAT

BEAT (Building Environment Assessment Tool) is a computer programme that assesses the environmental impact of building materials, building products and buildings. BEAT is based on the EDIP-method, but it can be used in other LCA-methodologies.

BEAT is made up of three parts:

- a database with information on energy sources, means of transport, products, building materials and buildings.
- a user-base that allows the user to add, update and delete data in the database.
- a computation part that allows the user to make calculations for products, building materials and buildings and print the results as input/output tables or as environmental profiles.

BEAT also includes a special module for determining environmental declarations for building products, a module that supports the environmental classification and declaration of buildings as well as a module for the simplified representation of buildings, which allows for BEAT to be used in the initial phases of project development to carry out environmental mapping and assessment of projects on the drawing board. BEAT is available in Danish, English, German, French and Spanish.

In principle BEAT can be used for the environmental assessment of all products, but BEAT is currently designed especially for the building sector. More information on BEAT can be found at www.by-og-byg.dk.

3.3 Methodologies for environmental labelling

A number of environmental labels already exist such as the EU-flower, the Nordic Swan Label and the German Blue Angel (see Fig. 3.2 below). All these environmental labels have the objective of assisting the consumer make a more environmentally friendly choice of products and are, in principle, based on product LCA's.

Environmental labels are built on the principle that products within a given category that meet a series of environmental requirements can be awarded the label. The environmental requirements are determined by a committee, which ensures that some products on the market already can be awarded the environmental label, while others cannot. In this way the consumer has the opportunity of choosing the environmentally best products. This will, hopefully, have an effect on product development in that producers will change their products and/or their production processes in order to reduce environmental impacts.

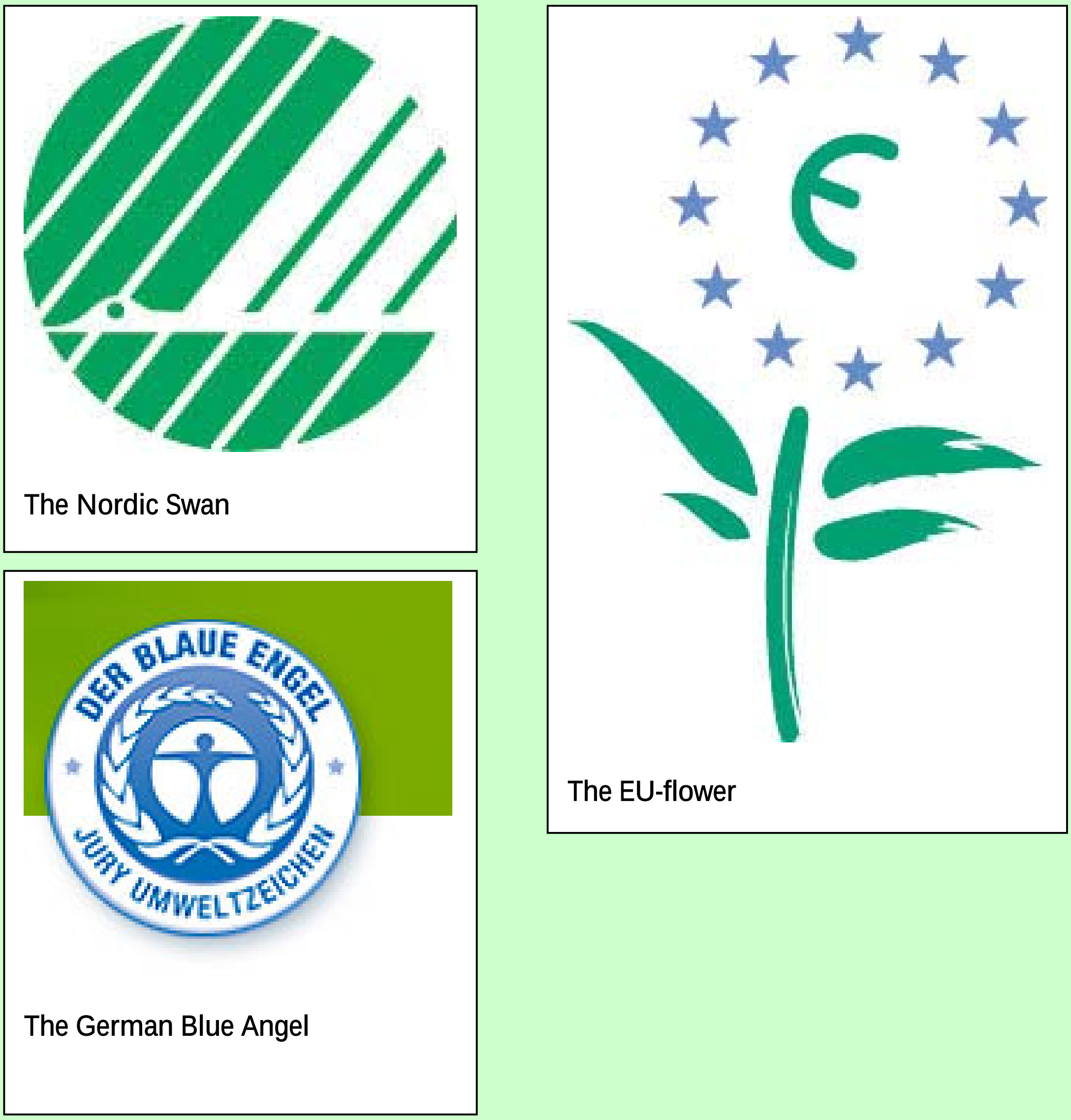
Environmental labels give the producer a simple message; that products with the eco-label are less environmentally harmful than those without the label, though there are cases whereby producers of unlabelled products choose not to have their products labelled despite the fact that they meet all requirements for obtaining the label.

There is a problem with the labelling system in that consumers cannot see which products are the most environmentally friendly amongst the labelled products.

More information on the Nordic Swan Label can be found at www.svanen.nu, Blue Angel at www.blauer-engel.de and the EU-flower at http://europa.eu.int/comm/environment/ecolabel/index.htm.

ISO is currently developing standards for environmental labels and the standardisation of products. The ISO 14020 series is being used for this purpose.

Figure 3.2: Examples of three European environmental labels: the EU-flower, the Nordic Swan and the German Blaue Engel



The Nordic Swan

The German Blue Angel

The EU-flower

3.4 Methodologies for environmental declarations

Environmental declarations are a more comprehensive description of a product's environmental impact during its entire life cycle. An environmental declaration usually includes an environmental profile of the product, which shows its impact on various environmental parameters.

Work is being done on standardising environmental declarations in order to produce a uniform and user-friendly declaration of a product's environmental impact.

ISO is currently developing standards for environmental declarations. These will be part of ISO 14020, which also includes eco-labelling.

A proposal for guidelines on environmental declarations for building materials has been developed in Denmark, which is supported by BEAT (see section 3.2.4). In early 2004 a general Danish project on environmental declarations was started, to be implemented by Danish Standards Association (Dansk Standard) and with assistance from the Danish Environmental Protection Agency (Miljøstyrelsen).

4 How can Product Standards reduce Environmental Impacts

This chapter gives an overview of the connection between product and environment and various methodologies to reduce a product's environmental impact. The objective of the chapter is to give those working with product standards the necessary tools to include environmental aspects in their standardisation work.

4.1 Methodologies for the reduction of environmental impacts

One of the main principles in environmental work with products is to reduce the overall negative environmental impacts connected to the product rather than moving the negative environmental effects from one phase in the life cycle to another. It is, therefore, important that one makes use of a product life cycle when handling environmental questions related to a product.

There are many ways of reducing the negative environmental impacts of a product. One can broadly divide the methodologies for environmental improvement up in the following way:

- Preventative methods, which involve cleaner production (the development of production processes, which have a reduced effect on the environment, including the introduction of new technologies (”cleaner technology”), design for the environment (the development of products so that environmental impact is reduced by substituting environmentally damaging substances), environmentally correct project planning (constructing buildings and structures so that they are less environmentally damaging)
- Recycling (reusing, reclaiming and reutilising products and materials) and the use of recycled materials in new products.
- Purification/cleaning measures (scrubbing of flue gas, waste water and so called ”end-of-pipe solutions”) and environmentally responsible deposition.
- Redress and cleaning provisions (cleaning up past pollution such as soil purification, restoration of waterways etc.)

Furthermore, a reduced consumption of products in general will reduce the impact on the environment.

The various ways of reducing environmental impacts are discussed below. A new standard under development, ISO 14062 “Environmental Management – Integrating environmental aspects into product design and development”, provides guidelines to how one can include environmental considerations into the product development phase.

4.2 Optimised process control

Production processes are defined according to product specifications and are generally optimised along economic production parameters such as production speed, use of raw materials and time of delivery. Production processes are also adjusted so that they remain within environmental requirements.

When production specifications change - either to maintain customer satisfaction or due to new standards being introduced – the production processes often change as well. On such occasions it can be advantageous to review opportunities for optimising the production process with respect to both environmental and economic factors.

It is, for example, important to ensure that the use of raw materials, subsidiary materials and energy consumption are optimised and that wastage is kept to a minimum. Most production processes today are automated or semi-automated so optimisation generally occurs in the use of materials. This also includes a reduction in faulty production, which will also decrease wastage.

It does not often occur that standards directly affect production processes, but standards issue requirements to products they can indirectly lead to changes in production processes and thereby lead to production process optimisation.

Figure 4.1: Example of optimised process management

The product standard on surface treatment of steel constructions (EN/ISO 12944-5 Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems) discusses a large number of surface treatments that all comply with the standard's requirements for durability, but which all have various economic, technical and environmental consequences associated with the painting process; e.g. both water-based and organic solvent-based products, which require different painting methods, drying processes and which have very different environmental consequences are discussed. Here it should be considered to optimize the technical and economic aspects in conjunction with the environmental aspects, which typically will result in application of the water-based painting systems.

It is, however, important in all such assessments that life cycle thinking is established so that all economic assessments of the production processes takes into account all environmental costs during production.

4.3 Optimised construction

There are many environmental advantages to be gained through resource optimisation in construction work as the following example in Fig. 4.2 indicates.

Figure 4.2: Example of resource optimisation (masonry)

1. Design of masonry structures

"Design of Masonry Structures Standard EC 6" (ENV 1996-1-1) is under development and will describe the technical and construction requirements for project planning, construction and implementation of masonry. EC 6 has been under development for 7 years and should be completed in 2004 after which it will be the only recognized standard on the subject.

2. Environmental aspects

The most important environmental aspect is reducing the use of materials in masonry. A reduced consumption of materials will in turn reduce the use of primary resources (clay, chalk, sand etc.), lower the energy consumption, reduced discharge etc.

The aim has been to include the results of a continuing optimisation of masonry constructions and materials. This optimization is necessary in order to ensure masonry's economic and quality competitiveness with other building materials, but this process also includes a number of environmental improvements.

3. Practical examples

It would be best to ensure that the safety standards of all constructions and construction materials are the same. This has led to standards for the dimensioning of beams, which was developed as a national parameter. In practice this means that when the values are known it leads to their use in project planning and therefore safer and more efficient – and resource efficient – buildings are constructed.

In EC 6 it is possible to calculate masonry's adherence and tensile strength in bending so that it can be shown whether masonry has sufficient bearing capacity and if steel pillars are necessary.

In some cases masonry constructions are built of a front wall and a back wall held together by wire bindings. The bearing capacity of the construction is determined by the individual wall's thickness and rigidity. Until 2002 EC 6 only contained a calculating formula that took the individual subsidiary wall's thickness into account. In other words both subsidiary walls were considered to have the same rigidity. If different materials were used in each wall then the construction would either be over dimensioned or under dimensioned leading to either a waste of resources or a safety hazard. A model has now been introduced that includes both rigidity and thickness, which allows for the correct dimensioning of each wall and, therefore, the optimisation of both safety and environmental aspects. The possibility of using different materials in subsidiary walls means more flexibility in the planning of constructions.

4.4 Substitution of environmentally hazardous substances

Substitution occurs for many different reasons e.g. production technology, customer pressure or safety reasons, but it can also occur for environmental reasons.

For example, substituting environmentally harmful substances in a product with less hazardous substances can result in reduced discharge of environmentally hazardous substances to the environment. In the cases where there are high costs or taxes are connected to the use or disposal of hazardous waste water, solid waste or flue gas, then substitution can both have economic as well as environmental advantages.

Figure 4.3: Examples of substitution

1. The European Standard for Admixes in Concrete, EN 934-2 allows for the use of superplastifying substances, which contain formaldehyde. This is an environmentally hazardous substance. As other products on the market have the same effect, but do not contain formaldehyde it could be advantageous to specify that formaldehyde be substituted by less hazardous substances.

2. "ISO 12944-5 Corrosion protection of steel structures by protective paint systems - Part 5: Protective paint systems" discusses the use of different paints and application techniques and mentions a number of substances that are effective in different forms of corrosion prevention.

   For example the use of paints with PVC and epoxyester as a binding agent, volatile organic compounds and pigments containing tin are all discussed. All these substances are problematic either for the environment or in the workplace, yet the standard only includes peripheral references to requirements for the labeling of the paints for occupational safety reasons. The standard is under revision and it has been recommended that environmental considerations should be taken into account in order to substitute these hazardous substances.

   The standard mentions both water-based paints and paints based on organic solvents. It is, therefore, already possible to choose between different types of solvents and, on this basis, choose the environmentally most appropriate solution.

4.5 Include recycling in the product

Most products become a waste product sooner or later, which has to be handled in a responsible fashion. The deposition of refuse has become more complicated and expensive over the years. This is due to the environmental problems involved in depositing refuse on landfills, lack of space for refuse handling and capacity problems at refuse handling plants. In some cases there is also a resource shortage as certain raw materials become scarce.

Due to this it is sensible, both environmentally and economically, to consider whether the product can be recycled when disposed of or whether the existing recycling can be expanded.

Planning increased recycling is best carried out in the product development phase e.g. one can increase the possibility of recycling by avoiding laminants and composite materials. Furthermore the labelling of individual components can lead to increased recycling. Fig. 4.4 gives a few examples of the inclusion of recycling in product development.

Figure 4.4: Example of the inclusion of recycling

1. Many car factories label the individual components so that it is easier to identify the various materials when the car is scrapped. There is currently work being done on ensuring that insulating foam and the steel chassis in fridges are more easily separated after use. Similar projects are underway in the electronics sector.

2. A way of making concrete more environmentally friendly is to include more reactive waste products from other industries such as flue ash from power stations and sediment from sewage plants. As these waste products often include heavy metals this may lead to problems when the structure is demolished, as the cement may not be recyclable. Crushed cement is often used as a filling material or as a bearing layer, and leaching of the heavy metals may occur. It is, therefore, important to think all aspects through using a long-term perspective before recommending recycling.

3. Eco-design for reuse. In connection with the EU directive on the collection of discarded electronic and electrical apparatus a computer based tool, Eco-design, has been developed. Eco-design makes it easier for product developers to consider deposition and, therefore, recycling in the design phase. An eco-design guide for electronics can be downloaded at www.ecodesignguide.dk

4.6 The use of recycled materials

Another possibility for improving a product's environmental profile is by using recycled materials instead of new raw materials. This is based on the presumption that there are clear environmental advantages in doing this, although this is not always the case.

There are a number of examples on environmentally and financially appropriate examples of use of materials with content of recyclable materials, e.g. the use of recyclable fibres in the manufacture of cardboard boxes. In this case a virtually a closed cycle exists as most cardboard boxes have a high percentage of recycled fibres (often over 90%) and many of the boxes are collected for recycling again. Other examples are newspapers, egg boxes, beer and soft drink bottles, and steel reinforcements amongst others.

Figure 4.5: Example of using recycled materials

In the building sector a widespread recycling of materials takes place, e.g. large amounts of flue ash (a waste product from flue gas cleaning filters in power stations, fired by pulverised coal) and micro silica (a waste product from flue gas filters used in the production of ferrosilicium and silicium metals) are added to concrete. Guidelines for using these products appear in the European product standard EN 206-1 for concrete.

4.7 Cleaning of discharge

The above-mentioned methodologies for improving a product's environmental profile are all preventative and are aimed at the product design phase. This is a phase in which product standards can have a large influence on the environmental impact of the product.

There are other methods to ensure a product's environmental profile improves. This includes purification/cleaning measures such as installations for the cleaning of flue gas and wastewater that is produced during production. An example of this is mentioned below in Fig. 4.6.

Figure 4.6: Example of "purification"

All concrete factories in Denmark have sediment basins to ensure that water with concrete sludge does not enter the sewage system, but that the sludge is collected and deposited or recycled instead.

Annex 1: Glossary of Terms

BEAT 2000	Building Environment Assessment Tool, developed by Danish Institute for Building and Urban Research
CEN	Comité Européen de Normalisation (European Committee for Standardisation).
CENELEC	Comité Européen de Normalisation Electrotechnique (European Committee for Electrotechnical Standardisation)
CEN EHD	CEN Environmental Help Desk
CO_2	Carbon dioxide
EN	European standard published by CEN or CENELEC
EMAS	Eco-Management and Audit Scheme developed by the EU.
Eurocode	European building standard
IPP	Integrated Product Policy
ISO	International Standardisation Organisation
LCA	Life Cycle Assessment
NWI	New Work Item
prEN	Proposal for European standard developed by CEN or CENELEC
PVC	Poly vinyl chloride
TC	Technical Committee
EDIP	Environmental Design of Industrial Products, developed by Institute for Product Development
VOC	Volatile Organic Compounds
WG	Working Group
WI	Work Item

Annex 2: List of References

1. Green Paper on Integrated Product Policy, EU Commission, 2001

2. CEN's environmental checklist: http://www.cenorm.be/boss/supporting/guidance+documents/

3. Integrated Product Policy: Building on Life-Cycle Thinking, EU, COM(2003) 302 final

4. EMAS: http://europa.eu.int/comm/environment/emas/index_en.htm.