Environmental Information in Instructions for Use of Consumer Products

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Nordic co-operation

Nordic co-operation, one of the oldest and most wide-ranging regional partnerships in the world, involves Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland. Co-operation reinforces the sense of Nordic community while respecting national differences and similarities, makes it possible to uphold Nordic interests in the world at large and promotes positive relations between neighbouring peoples.

Co-operation was formalised in 1952 when *the Nordic Council* was set up as a forum for parliamentarians and governments. The Helsinki Treaty of 1962 has formed the framework for Nordic partnership ever since. The *Nordic Council of Ministers* was set up in 1971 as the formal forum for co-operation between the governments of the Nordic states and the political leadership of the autonomous territories, i.e. the Faroe Islands, Greenland and Åland.

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Preface

The Nordic Strategy on Sustainable Development¹ states that the Nordic countries want to lead the way in developing and promoting a regional and global green market. According to the Environmental Action Plan, the Nordic countries want to make an effort to play a leading role in the development of environmentally preferable products, look for methods and tools to handle and present environmental and health information of products, and promote markets of environmentally preferable products. It is evident that environmental information to consumers and companies has a remarkable role in the work.

The European Union has highlighted the issue of environmentally sound use of products in the context of Integrated Product Policy, IPP. Accordingly, consumers should have easy access to understandable, relevant and credible environmental information. Information about product characteristics is available in different forms and sources, but in many cases, relevant environmental information is not available on the product itself.² The Commission's paper pays attention to the continuous economic growth, which reflects as an overall increase in consumption and availability of more complex and global products. The need for more adequate instructions of environmentally sound use increases together with the growing number of products in household.

The study described in this report was initiated in order to produce information on the state of user instructions regarding environmental information. The project has been managed by Finnish Environment Institute (SYKE, www.ymparisto.fi). The principal researcher was MSc Katriina Parikka, and the project leader was senior researcher PhD Ari Nissinen.

Several companies, industrial associations and other stakeholders participated in the six feedback groups of the study. Project researchers are deeply grateful for the insight they gave to the world of product design, manufacturing and marketing.

The project was funded by The Nordic Council of Ministers (NMR). ThemeGroup 5 ('Environmental information – consumers') under the NMRIPP-group recognised the need to analyse the state of environmental information in user manuals and has guided and supervised the work from the very beginning of the idea development. The feedback and support from the group members is greatly acknowledged:

¹ NCM (Nordic Council of Ministers) 2001. Sustainable development. New bearings for the Nordic countries. www.norden.org/pub/miljo/sk/2001_507uk.pdf.

² European Commission 2001. Green Paper on Integrated Product Policy, Brussels. <http://europa.eu.int/comm/environment/ipp/ippcommunication.htm>.

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Summary

User manuals of passenger cars and refrigerators were focused on in a Nordic project, examining the advice which could diminish the harmful environmental effects of the use of these products. Other studied products included such durable products as textiles and furniture as well as such consumables as cleaning chemicals and recyclable paper products.

Energy consumption, length of life time, daily use practices and disposal of products are aspects influencing the environmental burden that products create in the use phase. The environmental impacts of use can be large in respect to the impacts of the whole life cycle, e.g. for cars and electrical devices which use fuel or electricity and include hazardous chemicals.

The user manual and other information attached to the product are the primary source of user information, but also the roles of the seller, authorities, various organisations, media and school are essential. For cars and refrigerators a large part of the relevant environmental aspects were advised in every manual, however areas for improvements still exist. The way of presenting the information varied a lot. Especially, motivating the users and explaining the connections of advice to the relevant environmental impacts could have been presented more often. Separate quick-eco-manuals are proposed for these products, as the environmental advice is in many cases scattered throughout the thick manuals, which may often be unread.

For sofas, a user manual rarely exists and thus it would be important to develop these for sofas and other furniture; the material content and care instructions should be given. A washing declaration is given in textiles, but additional information on care would be important, and it could be delivered in a form of attached one-page leaflet.

In the product group of detergents, clear presenting of dosing information according to water hardness is important, but was not clearly presented in many of the studied products. Retailers and water supply authorities could place the information about local water hardness available in the shelves of cleaners in the store. In addition, information on the use of the product could be available e.g. in the Internet.

For envelopes and recyclable paper products in general, the role of recycling companies and local authorities is crucial. Detailed advice on sorting and recycling of envelopes and other paper products is difficult to give by the manufacturers because collection systems and sorting advice vary regionally, and households and work places often have different sorting facilities.

Many newspapers, magazines, and programs in TV and radio already deal with proper use and care of different products. Seasonal advice on e.g. car care before winter and de-icing and cleaning freezer before harvest time in late summer are common. However, media could take a larger role in reminding consumers of environmentally sound use of different products. For many people, schools offer the basic instructions of e.g. textile care and household practices, and therefore their role in learning sound and proper use of various products should be strengthened and reassured.

In developing proposals for further actions, the researchers recognized the need to raise the general status of user manuals, as well as the need to improve their quality regarding the environmental aspects. User manuals and other kind of user instructions should be paid more attention to so that people would consider them important. And the instructions should, better than today, present all the important environmental aspects of product use, and preferably in a clear and motivating way.

The study raised many ideas about actions that could promote the status and 'eco-development' of instructions for use (IFU). These include quick-eco-manuals for various products, Internet-site 'Eco-Manuals for Consumers', seminars, a contest of best IFU, and proposals to the standardization organizations to add more focus on the environmental aspects in the standard of IFU and in the standards of various products.

It was not easy to find effective ways to promote the use of IFU among consumers, as well as their activity in asking for environmental aspects of product use. However, a leaflet and accompanying press releases could raise interest among consumers as well as among media, manufacturers and sellers. Finally, co-operation with school administration could be further developed.

Sammanfattning

Bruksanvisningar för personbilar och kylskåp var i fokus i ett nordiskt projekt, i vilket man undersökte olika slag av bruksanvisningar som kunde leda till en minskad miljöbelastning under produktens användning. Man studerade också andra produkter, t.ex. kapitalvaror som textilier och möbler samt konsumtionsvaror som städkemikalier och återvinningsbara pappersprodukter.

Energikonsumtion, livslängd, produktens dagliga användning och sortering av avfall påverkar den miljöbelastning som produkten ger upphov till under användningsfasen. Miljöbelastningen under användningsfasen kan utgöra en stor del av en produkts totala miljöbelastning. Detta gäller t.ex. bilar och elektriska applikationer som använder bränsle eller elektricitet och som innehåller farliga kemikalier.

Bruksanvisningen och annan information som medföljer en produkt utgör produktens huvudsakliga användarinformation, men även säljaren, myndigheter, olika organisationer, media och skolor är viktiga informationskällor. Alla de undersökta bruksanvisningarna till bilar och kylskåp innehöll en stor del av den relevanta miljöinformationen, även om det ännu finns utrymme för förbättringar. Presentationen av informationen var mycket varierande. Bruksanvisningarna kunde oftare ha innehållit motiverande information samt uppgifter om kopplingen mellan bruksanvisning och miljö problem. Speciella snabb-eko-manualer föreslås för dessa produkter, eftersom miljöinformationen i dagens läge vanligen är utspridd i tjocka bruksanvisningar som ofta förblir olästa.

För soffor finns det sällan bruksanvisningar och därför vore det viktigt att utveckla sådana såväl för soffor som för andra möbler. Dessa bruksanvisningar kunde innehålla uppgifter om tillverkningsmaterial samt skötselråd. Textilier är utrustade med tvättråd, men ytterligare skötselråd borde medfölja, t.ex. i form av en enkel broschyr.

Hos rengöringsmedel är det viktigt att doseringsanvisningarna vid olika hårdhet hos vattnet är åskådligt presenterade. Hos många av de undersökta produkterna var denna information bristfällig. Detaljhandlarna och vattenmyndigheterna kunde informera kunderna om det lokala vattnets hårdhetsgrad vid affärens rengöringsmedelshyllor. Användarinformation om produkten kunde också göras åtkomlig t.ex. via Internet.

När det gäller emballage och återvinningsbara pappersprodukter i allmänhet innehar återvinningsindustrin och lokala myndigheter en avgörande roll. Eftersom återvinning och sorteringsanvisningar varierar regionalt, är det svårt för produkttillverkarna att tillhandahålla detaljerade anvisningar för dessa produkter. Hushåll och arbetsplatser har dessutom ofta olika möjligheter till sortering.

Många tidningar, tidskrifter och program i radio och TV behandlar redan användning och skötsel av olika produkter. Det är vanligt med årstidsvisa råd gällande t.ex. bilens vinterservice eller avfrostning av frysen före skördeperioden. Media kunde ändå spela en större roll när det gäller att påminna konsumenterna om en miljömedveten användning av olika produkter. Skolväsendet erbjuder många människor grundläggande kunskap om t.ex. textilskötsel och hushållsskötsel och därför borde skolans roll vid inläringen av en korrekt användning av olika produkter stärkas.

När forskarna utvecklade förslag till ytterligare åtgärder, konstaterade de att bruksanvisningarnas status borde höjas samtidigt som deras kvalitet angående miljöaspekter borde förbättras. Bruksanvisningar och andra former av användarmanualer borde ägnas större uppmärksamhet så att konsumenterna skulle anse dem viktiga. Instruktionerna borde också i högre grad än i dag presentera alla viktiga miljöaspekter hos produkternas användning på ett åskådligt och motiverande sätt.

Studien väckte många idéer till åtgärder som kunde höja bruksanvisningarnas status och "eko-utveckling". Till dessa hörde snabb-eko-manualer för olika produkter, Internetbaserade "Eko-manualer för konsumenter", seminarier, en tävling för bästa bruksanvisning, och förslag till standardiseringsorganisationerna om att dessa skulle lägga större vikt vid miljöaspekterna i standarden för bruksanvisningar och i olika produktstandarder.

Det var inte lätt att hitta effektiva sätt att befrämja konsumenternas användning av bruksanvisningar eller att få dem att aktivt fråga efter information om produktanvändningens miljöaspekter. En broschyr med tillhörande pressmeddelanden kunde höja intresset såväl hos konsumenterna som hos media, tillverkare och säljare. Slutligen borde samarbetet med skolväsendet utvecklas ytterligare.

Definitions

Environment: "Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation" (ISO 14001. 1996, 13).

Environmental Aspect: "Element of an organization's activities, products or services that can interact with the environment." (ISO 14001. 1996, 13.)

Environmental Impact: "Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services." (ISO 14001. 1996, 13.)

Externalities (External Costs): "Spill over costs or benefits, unintended consequences or side effects (either beneficial or detrimental) associated with market transactions. Pollution is an example of an externality." (Kahn 1998, 21.)

Instructions for Use (IFU): "Information by the producer of a product for the safe and efficient use of the product" (IEC 62079. 2001, 19). In this study the term 'instructions for use' is considered extensively covering instructions in the product itself, in the package, and in accompanying material.

Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle (ISO 14040. 1997, 9).

Life Cycle: Consecutive and interlinked stages of a product system, from raw material acquisition or generation of natural resources to the final disposal (ISO 14040. 1997, 9).

Sustainable Consumption: "Patterns of consumption through which purchase and use of goods and services meet people's basic needs while minimizing any environmental degradation" (Cooper 1998).

User Manual –Document containing user information, for example instructions (IEC 62079. 2001, 19). User manual can be a part of the instructions for use.

Key Words -Instructions for use, Environmental Aspects, Environmental Impacts, Environmental Information, Products, Consumers, Sustainable Consumption

1. Introduction

Environmental effects during the use of a product can be significant compared to the impacts of the whole life-cycle, for example in the case of cars and electrical devices, which use fuels or electricity and may contain hazardous chemicals. It is important that the user gets advice on the proper use of such products. Instructions for use serve as evident source of such information, and they should, according to the Standard IEC 62079 present all the information that is needed for safe and proper use of the product, including such aspects as proper waste handling and saving of energy and other resources. However, it is evident that in most cases this information could be improved considerably.

Instructions for use (or user manuals) accompanying products are the key source of information regarding the environmental aspects. It is clear that manufacturers include more and more environmental aspects in the instructions at the same time as the environmental consciousness increases. When preparing the product specific instructions for use, manufacturers receive guidelines from the standard IEC 62079 as well as from the product specific standards. These standards are also useful when assessing the instructions. In addition, many sources such as eco-label criteria and product related literature provide information on the environmental aspects that are important for each product.

The goal of this project was to examine how the instructions for use could be improved, regarding the environmental aspects that are important in the use phase of different products.

Objectives of the study were:

1. to examine what kind of environmental information and advice the instructions for use of products include now,
2. to analyze what kind of information and advice they should include in order to reduce the harmful impacts during the use phase,
3. to consider how consumers are instructed in addition to the instructions for use and who could deliver the information, so that the impacts of use of various products could be decreased
4. to present guidelines and examples of the existing ones, that help taking the environmental aspects better into account in the development of user instructions.

Next, in chapter 2, we discuss about the main environmental aspects of use of products and introduce the tools for environmental product information as well as the parties delivering this information. Chapter 3 ex-

plains the research method and data sources. In chapter 4 an overview of the current state of instructions for use is given, as well as suggestions for improvements. The concluding chapter 5 presents the major findings and suggestions for further actions.

2. Sustainable Use of Products

Much of the research to date on environmental issues in user information has focused on the eco-labels as a source of consumer information and the accuracy of claims in environmental marketing. In addition, issues such as life cycle assessment and environmental product design have been areas of interest. Also research activities on sustainable consumption have lately increased.

The main sources of the environmental impacts during the product's life cycle are fairly well known. So is also the correct use of products in order to reduce the harmful environmental effects. In many cases, however, the environmental information is given in too general level to have an effect on consumers' daily routines, or consumers may not clearly understand the consequences of energy consumption and its relation to environmental impacts (Heiskanen 1995, 9, 31). Although the role of consumption in causing various environmental problems has been stressed, and better guidance has been proposed, it has not been clearly indicated whether there are flaws in instructions for use and what these could be. No study was found that would compare the important product specific environmental aspects to the information given in the user manuals.

2.1 Environmental Impacts and Aspects of Product Use

It is estimated that in industrialized countries between 30 - 40 % of all environmental problems can be assigned to private households (UBA 1997). The trend towards increased and unsustainable consumption is a consequence of economic growth, rise in per capita disposable income and changes in lifestyles, and increase in properties of the products and ownership of more appliances. Environmental impacts of use are mostly due to material and energy outputs during the products operational or disposing phase. Energy use, water consumption and waste generation are the main areas of household activities causing global, regional and local environmental impacts. (OECD 2002a, 6.)

Energy Consumption

Energy consumption contributes to climate change by fostering the depletion of fossil fuels and increasing CO₂ emissions. Households have an impact on energy consumption through their daily use of vehicles, different home appliances and space heating. In recent years, household direct energy consumption has accounted for 15 - 25 % of the national energy

use in OECD countries and it is considered as one of the fastest growing sectors of energy use (OECD 2001).

Especially in Nordic countries heating is a major part of the overall energy consumption accounting for 35 % of the total average household energy consumption. The rest 65 % is divided between passenger car use (35 %), home appliances (20 %) and water heating (10 %). (Adato Energia 2003.) Refrigerators' and freezers' share of electricity consumption in OECD countries accounts for 20 % of the total household electricity consumption. (OECD 2002a, 16, 20.) For example, in Finland, refrigeration appliances and lighting will consume the greatest shares of household electricity in 2010, followed by consumer electronics, cooking and sauna (Korhonen et al. 2002, 7). It is also worth noticing that standby power of household appliances is responsible for 10 % of household electricity consumption (IEA 2001).

Water Consumption and Waste Water

OECD countries are the largest users of water, consuming three times more than an average person in East Asia, Latin America, Africa or India (OECD 2002a, 23). In addition to the depletion of water resources, water consumption contributes to the increase in waste water releases. Although sewage treatment facilities are common in developed countries, in some cases waste water still ends up to the environment, for example if a car or textile is washed near the waterfront or in the areas with no or poor sewage treatment facilities. In addition, households may contribute to water pollution by pouring oils and other harmful chemicals down the drain.

Household Waste and Hazardous Chemicals

Household waste is a major environmental concern since the generation of household waste is projected to increase significantly (43 %) to 2020. In OECD countries households generate on average 67 % of municipal waste loads, which is around 500 kg per person per year (OECD 2002a, 6, 38). Increased amount of waste is correlated to the increased consumption of natural resources. Thus, the prevention of waste is closely related to the improvements in products' material and eco-efficiency. Product's life time can be extended by modernizing, repairing and favoring reuse.

In addition, if treated inappropriately, end-of-life products are a source of ground and water contamination and of air pollution, and may also lead to alteration of the environment in terms of visible nuisance. A special problem is caused by hazardous chemicals, or products containing them. These include e.g. batteries, accumulators, waste oils, fluorescent light tubes, medicines, paints, glues, solvents and other toxic materials (YTV 2004). Finally, burning waste causes polluting emissions in the air, in the form of e.g. acidic gases, polyaromatic hydrocarbons, dioxins and furans, dust and heavy metals (OECD 2002a, 43).

In many cases waste generation and disposal of products and substances is regulated by national laws and local regulations. However, shortcomings in the presentation of environmental information and material content of goods may be a barrier to efficient and appropriate end-of-life procedure of the product.

Emissions

Motor vehicles and various machines (e.g. lawn movers) are products that can pose serious health risks and contribute to ecological instability in terms of air pollutants and acid rain. In addition, air pollutants contribute to global warming and destruction of the ozone layer. Traffic is a major source of carbon monoxide (CO), nitric oxides (NO_x) and hydrocarbons (CH_x). It emits also a variety of organic substances that can have carcinogenic health effects and several other health risks. "Car use alone is responsible for approximately 90 % of CO emissions from mobile sources, 80 % for hydrocarbons, and 50 % for nitrogen oxides" (OECD 2002b, 7). Smog is one harmful result of air pollutants. The main environmental aspects and impacts of products are summarized in table 1.

Table 1. Environmental aspects and impacts of product use

Environmental aspect	Environmental impact	Extension of impact
Energy consumption	Emissions of CO ₂ and other green house gases -> climate change. Depletion of non-renewable resources.	Global
Product life time	Depletion of natural resources and biological diversity.	
Emissions of pollutants	Air, water and soil pollution -> smog, eutrophication, acid rain.	Global Regional Local
Hazardous items and chemicals	Water and soil pollution, toxicity.	Regional
Noise, visible nuisance	Alteration of environment. Health problems.	Local
End life	Waste as visible harm. Substances from abandoned products. Depletion of natural resources.	Local Regional Global

2.2 Sustainable Use Patterns

Environmental discussion has only recently focused on household consumption patterns as drivers towards sustainability. These sustainable patterns include decrease in energy consumption and increase in material-efficient use of products. Extension of the product life time or increased service utility gained from products can be reached by reuse, recycling of materials, repair, modifying and modernizing products, as well as shared use and re-use of the same product (Oosterhuis et al. 1996, 71-72).

In some cases the shift towards durable use patterns can be seen as a gradual process from short term changes to long term impacts. This is the case for example with motor vehicles. In the short term household's only action is to drive economically and drive less by avoiding short and unnecessary trips. In the medium run environmental aspects affect their choices of vehicle and travel mode, and in the long run, the location of residence or work place becomes relevant. (OECD 2002b, 19.)

Changes in consumption procedures are, however, usually more complex. Consumer decision making is a multilevel process affected by many interests such as price, quality, lifestyle, social aspects and other driving forces of the economy (OECD 2002b). For example, a German study on sustainable consumption patterns identified four different types of users to which new use concepts should be targeted. These include 'ownership-oriented', 'open-minded', 'consumption-oriented' and 'low interest' con-

sumers. “Most relevant target groups for use intensification are ‘open-minded’ consumers, while prolongation of product life should primarily be addressed to ‘ownership-oriented’ ones”. (Hirschl et al. 2003.) Different types of audience are worth recognizing when planning targeted campaigns on sustainable consumption patterns.

New consumption patterns can be achieved most successfully if the product design supports the sustainable use patterns (Oosterhuis et al. 1996). For example, the product life time could be prolonged by increasing product's durability, adaptability, maintainability and reparability, and products could be designed in a way that makes the treatment in the use and disposal phases more environmentally sound (Eco-Design).³

2.3 Tools for Delivering Environmental Information on Product Use

In this study we consider the term 'instructions for use' extensively, covering instructions in the product itself or its packaging, and accompanying material. This accompanying material may include a user manual and other documents. On the other hand, some products, such as paper and other recyclable products, may need additional instructing provided by local recycling companies or authorities, and thus the focus is broaden to the discussion about the role of different actors in producing and delivering these kinds of instructions.

National laws place requirements for the sufficient product information and instructions for use. For example, in Finland the Consumer Protection Act (2001) states that a product contains an error, if the instructions for use are not delivered to the consumer, or if the data are insufficient. For some product groups the regulations are stricter, such as for chemicals and electrical products that may cause danger to the consumer. For some product groups it might only be stated that sufficient product information should be provided. Consumers are entitled to get instructions where safe and proper use, assembly, maintenance and storage of the product are appropriately instructed. The EU Council Resolution on operation instructions for technical consumer goods, encourages manufacturers to follow the standards concerning instructions for use, and gives recommendations about the way the instructions should be presented (EU 1998).

User manual, or a separate leaflet, including guidance about assembly, repair and safe use of a product, is perhaps what first comes to mind of 'user instructions'. Also the physical package of a product is a means of communicating environmental information in terms of phrases, images or standardized markings and eco-labels. Some instructions for use may be

³ See more in Chapter 2.5. Links to Eco-Design and Environmental Product Declarations

given as logos printed in the package. The most common logos are probably the ones guiding waste separation and recycling. Another example of this recent form of communication of product-related environmental information is a 'Wash-Right' reference or symbol in a package that guides the consumer to look for the user information in the Internet. In many cases, however, an extra action must be taken to gain the information from the Internet. Although it has been suggested that consumers are willing to "seek" environmental information about products (Carlson et al. 1993) the instructions for use should be easily accessible and readable in a moderate time.

Environmental information in packages can of course be misleading. One of the categories of misleadingness named 'no explanation' means that the environmental claim does not include important information necessary to evaluate its truthfulness or reasonableness. For example, recyclable is stated on the packaging, without expanding to describe what specific part of the product the information is referring to, and how the consumer can deliver the waste to the recycling system. (Polonsky et al. 1998, 285.)

There are three important characteristics that good instructions for use should have. They should inform, guide and warn. Other requirements for good instructions include for example a 'quick guide' of the user manual, as well as durability to bear the conditions where the product is used. (Rättö-Ihalainen 1997, 5.) The general criteria for instructions for use of all kinds of products are defined in the standard (IEC 62079) 'Preparation of instructions, structuring, content and presentation'. At the present, the standard does not inform how to instruct about environmental issues, although it includes many important environmental issues, e.g. in the chapters of health, safety and maintenance, which must be paid attention to in instructions for use. Various product-specific environmental aspects are also assessed when determining the criteria for Nordic and European Eco-labels. These criteria include requirements for instructions to consumers, too. These requirements are also useful when assessing and improving the content of instructions for use of such products.

Much of the literature examining consumers' environmental behavior suggests that the more information they have, the more "environmentally responsible" their actions will be⁴ (Polonsky et al. 1998, 282). On the other hand, it is claimed that the more information is given to the consumer about the correct use of a product, the more of this information will not reach the consumer's mind and behavior. Therefore it is essential to modify the message to the level of the respondent, i.e. consider consumers' awareness on the issues to be instructed, and their ability to adopt the guidance. (Rättö-Ihalainen 1997, 36-37.) Finally, the outcome,

⁴ However, according to Polonsky this relationship can not be generalized to all activities.

whether the instructions reach the user, is dependent on many variables, such as the user's time and willingness to follow the instructions.

2.4 Actors Delivering User Information

Various actors are involved in delivering user information. Major parties are governmental institutions, producers and traders. The product-specific information can be given by the manufacturer, importer and the seller. In addition to the user manuals provided by the manufacturer, the verbal communication in the purchasing situation may include relevant product information. Thus, these three actors; the manufacturer, middleman and the seller, are mainly responsible for providing and delivering sufficient product information to consumers. (Rättö-Ihalainen 1997, 12-13.)

There are also other parties such as industrial associations, media, environmental and consumer organizations, research institutes and recycling enterprises that contribute to the delivery of consumer information and may successfully promote awareness of environmental impacts of use and guide consumers towards sustainable use patterns. Tools for this kind of promotion could be e.g. open discussion, campaigns, consumer advisory centers, trade fairs, published articles and other documentation and advertising.

School is evidently a source of reliable information on reasonable household practices, which includes basic guidance on proper use of various products. It is important that administrations, education, consumer and environmental organizations co-operate, to assure that environmental aspects of consumption and basic knowledge of household products and textiles are well covered in the education.

Traditionally, governmental institutions have set the basic requirements for user information in the form of directives, so that the product must be accompanied by sufficient advice on proper use. Also important governmental information instruments of promoting environmental awareness include e.g. campaigns, eco-labeling, media, open discussions, education and certain projects. (Oosterhuis et al. 1996, 6.)

Also the role of consumers has lately been under discussion. Consumers' responsibility lays on the environmentally sound choices, use patterns and disposal of products. It is important that consumers are more aware of environmental issues and sustainable use patterns. However, at the same time it can be criticized that even too much of the responsibility for environmentally sound consumption is laid to consumers (Moisander 2003). Although the importance of individual consumers as actors towards sustainable consumption is evident, this does not mean that also consumers' responsibility of such consumption behaviour should be as enormous, since in reality, many daily life restrictions, such as western cultural habits and socio-cultural matters, reflect to consumers' possibili-

ties to act according to the latest environmental guidance. However, one response to this is that if consumers adopt the more environmentally sound consumption procedures, this will not require major sacrifices or much time, since once the new procedure has been adopted as a daily routine it can be carried out in the same amount of time than the former consumption pattern. (Moisander 2003, 168-171.)

In order to use and dispose the product in a more environmentally friendly way, the consumer needs to increase his awareness and knowledge of environmental aspects of product use. To understand the environmental consequences of using the product may increase the motivation to act 'sustainably'. But even if the consumer was willing to take actions to minimize the harmful impacts of use, there is relatively little that the consumer can do if the environmentally friendly use of a product is not appropriately instructed. Therefore, the challenge of increasing the environmentally friendly use patterns is not only up to the consumers but to the actors having more negotiating power e.g. legislators, business, industry experts, designers, producers, sellers of the product, as well as schools, administrative and communications actors and researchers. It is likely that a high level of consumer awareness on environmental issues is an important success factor turning the use of products from unsustainable basis towards sustainable consumption. At the same time, it would certainly motivate manufacturers and sellers to improve the instructions concerning the environmental aspects of their products.

Instructing consumers of correct use is seen a key challenge to make the use of products more environmentally friendly. The way towards sustainable consumption is thus the result of changing the product with regard to its environmentally harmful features and changing the product use and disposal into an environmentally sound direction.

3. Methodology

3.1 Research Method

In this study a combined qualitative and quantitative approach was chosen so that the research questions of type "how", "what" and "how much" could be answered (Table 2). First a qualitative research was carried out to find out what should be instructed for various products. This was done by examining literature about product- and environment related matters. In addition, product-specific documents were studied, i.e. existing user manuals to find out what has been generally instructed. Group discussions with a limited number of informants, also called as feedback group, were used to assure the relevance of environmental aspects found, and to help in defining the criteria for assessing the level of environmental information in instructions for use.

On the other hand, the question "how much environmental information is included in the instructions for use at the moment" called for examination of the current user manuals and other instructions. Therefore the quantitative research was used to identify how many of the criteria defined in the qualitative part existed in instructions for use at the moment. Product groups that either have user manuals (cars, refrigerator-freezers) or include information on the product or package (cleaning agents) were included in this study. This part was implemented as a desk research of samples from each product group. The assessment procedure agreed with the assessment criteria for instructions for use defined by Standard IEC 62079, which provided a checklist of the content of the instructions and the way they should be presented. This checklist was modified according to environmental point of view and completed with the findings from the product specific literature and the comments from the feedback groups (Appendices 1-6). As an outcome, it was possible to assess the present state of the environmental guidelines in instructions for use, as well as to make suggestions for improvements.

Table 2. Two-phase research design of the study

Research Phases	1. Development of criteria for assessing instructions for use of various products	2. Assessment of instructions for use
Data Collection Types	<u>Documents</u> <ul style="list-style-type: none"> • literature about consumption and environment • instructions for use • product standards • environmental product declarations <u>Interviews</u> <ul style="list-style-type: none"> • group discussion (feedback groups) 	<u>Sampling</u> <ul style="list-style-type: none"> • 12 cars • 6 refrigerator-freezers • 15 all purpose cleaners • 25 laundry detergents <u>Desk research</u> <ul style="list-style-type: none"> • method for assessment of instructions for use defined by IEC 62079 • criteria for assessment developed in phase 1
Data Analysis	What and why these issues are advised? Who is active / who could do more?	How many of the criteria developed in the first phase exist in the instructions for use?
Outcome	Criteria for the assessment of environmental information in instructions for use.	Assessment of the current state of environmental information in instructions for use and suggestions for improvements.

3.2 Product Categories and Groups

The categorization of products in this study divides products into non-recoverable and recoverable consumables, and energy-passive and energy-consuming durables. This classification was written by Frankl & Pietroni (2002) and introduced in the DEEP⁵ –Project Final Report (Figure 1). One of the key criteria in the formation of categories was that the main environmental impacts over the life cycle occur in similar phases among products in a category, which makes generalization of results within a category possible.

A variety of products exist in each category. The selection of product groups within a category was based basically on two criteria. Firstly, it was important that the products chosen were commonly used in households. Secondly, the results of the study should be to some extent adapted to the other product groups within a category. Keeping these two criteria in mind, we selected products that are generally considered to produce remarkable environmental impacts and thus include many environmental aspects.

Non-recoverable consumable goods

Non-recoverable consumable goods usually have their main environmental impacts during the production phase but might also have significant impacts during the end-of-life (Frankl & Pietroni 2002, 54).

This category consists of products that cannot easily be recycled or reused in households. Usually these products end up down the drain or become waste. A common and important product group is cleaning chemicals. **All purpose cleaners** and **household laundry detergents** account for 53 % of the total cleaner markets in the EU Member States, Norway and Switzerland (AISE 2002, 4) and the average con-

⁵ DEEP: Developing Effective and Efficient Product Information Schemes

sumption of detergents in Nordic countries has been around 5 kg per year per person, although the European average consumption is even double (Fox et al. 2002). The total consumption of cleaners and detergents pose a remarkable potential for ground and water contamination.

Recoverable consumable goods

"Recoverable consumable goods can be collected and their materials recycled. Therefore, they can have their main environmental impacts both during the production phase and the end-of-life, depending on whether the material is actually recycled or not. For instance, if paper or wood consumable products are not recovered and are brought to landfill, the greenhouse gas emission emitted there are the most significant contribution over the whole life cycle." (Frankl & Pietroni 2002, 55.)

The selection of product group in this category was limited on the products that have the common recycling system in place. This is usually determined nationally, or locally, but one of the most common recycling system in many countries, is the **paper** recycling system. Although the recycling systems work out fairly well for example in the Nordic countries, the recycling rates in the Western Europe (55 – 60 %) indicate that huge amounts of paper still ends up to landfill waste (Paperinkeräys Ltd 2004.) On the other hand, there is an enormous potential to decrease the consumption of paper, since each year industrial countries use an average of 164 kg paper per person, while developing countries use only 18 kg / person. As an example, the average office worker in the United States consumes around 12 000 sheets of paper per year. In addition to offices, it is estimated that households could cut their paper use easily by 30 %. (Worldwatch Institute 1999.)

Within this category we discussed also how well the recycling of materials is instructed to the user, and which party (user, recycling company, consumer organization, etc.) is responsible for instructing the correct recycling method of a specific product to the consumer.

Energy-passive durable products

Major environmental impacts in this category occur mainly in the production and end-of-life phases (Frankl & Pietroni 2002, 56). Although these products do not need energy while functioning, the maintenance of products may include actions that are very energy intensive such as washing and cleaning. As an example, it is estimated that wash and care practices account for two thirds of the total environmental load during the textile's entire life cycle (Talvenmaa 2002, 57, 84; Suojanen 1997, 51.) Thus, in addition to advice on washing, instructions for use should provide advice on prolongation of product life time.

For energy-passive consumable goods we chose **textiles (garments) and furniture (sofas)** that are common household products. Textiles fulfill the function as cover and a sign of personal style, and furniture is a

traditional item increasing comfortableness at home. In addition, they both have important environmental aspects in the use phase.

In 1999, clothing and footwear accounted around 6 % of household expenditure in the EU-area (Consumers in Europe 2001). It is estimated that during the years 2002-2005 the consumption of clothes will increase 9 % in the EU-area. The greatest increase in consumption of textiles and clothes is likely to take place in Russia with 44 %, and in the Eastern Europe with 17 % estimated rise. (Taloukatsaus 2003.) Since the amount of textiles is excessive, the study was limited to cotton, silk and woolen garments.

Consumption of furniture has slightly increased during the last 20 years. Every year, between 8 – 10 million tons of furniture is disposed in the EU countries, which accounts for around 35 % of the EU municipal bulky waste gathered from households. As an example, almost 12 million pieces (1 176 tons) of sofas and armchairs are annually purchased in the EU-area, 80 % of which are replacement purchases. Only one third of the replaced items is reused or recycled. (UEA 2004.)

Energy consumable durable products

Major environmental impacts of products in this category are related to the use phase. Therefore it is important to give all the relevant guidance on how to use the product in environmentally friendly way. This advice could be given in instructions for use or by the product itself. "For example, the guidance might be combined with eco-design solutions (e.g. refrigerators which set off an alarm if they are opened for too long)" (Frankl & Pietroni 2002, 56).

Although television seems to be a common item in households, the largest single sources of household electricity consumption after space and water heating are refrigerators and freezers (Energy+ 2003, 4). Cold appliance's share of electricity consumption in OECD countries accounts for 20 % of the total household electricity consumption (OECD 2002a, 16, 20). Since there are major environmental benefits of reducing energy consumption of cold appliances, the **refrigerator-freezer** was selected as one product group to be examined.

Passenger cars were also chosen due to the heavy environmental drawbacks of use e.g. CO₂ emissions. A large part (90 %) of the environmental burden of cars arises from the use (Autoalantieto 2004). Passenger cars account for about half of the transport-related CO₂ emissions in the European Union (Transport and CO₂ 2004) and the amount of passenger cars seems to be increasing. In the beginning of 21st century, over 10 000 passenger kilometers were taken per person per year in the EU-area (Energy & Transport in figures 2003). Today, over 15 million passenger cars are registered in Europe, which is around 2 million vehicles more than in the year 1990 (ACEA 2004), and worldwide around 600 million passenger cars are in use (SMMT 2002). If proportioned to the

number of inhabitants, the average number of persons per car is 1,5 in the EU countries.

Small and medium sized family cars are the most common models covering 7 of the 10 top car models (Ketonen 2003, 76). In the EU area, the highest share of new passenger car registrations remain in the small segment with 34,2 % of total new registrations followed very closely by the medium segment with 32,4 % of total new passenger car registrations (ACEA 2004). Thus, small and medium sized family cars were selected in the survey of manuals.

Figure 1. Classification of product categories (Modified from Frankl & Pietroni 2002, 51.)

3.3 Participants in the Feedback Groups

Feedback groups for each product group were formed by inviting 4 – 6 representatives from companies, including people from engineering, product development, communication and environmental affairs, as well as third parties from industry and consumer associations who do not have a direct stake in the formation of product manuals. Companies that are present in the Nordic countries or have wider markets were selected, e.g. car manufacturers from Nordic countries (Volvo), Europe (Audi and Volkswagen) and Asia (Toyota). In addition, we preferred companies that have performed successfully in environmental issues, for example have

acquired eco-label for their product, since these companies were also likely willing to participate in the development work of instructions for use.

3.4 Selection of Samples

Samples of instructions for use were collected for cars, refrigerator-freezers, detergents and all purpose cleaners. Car user manuals were asked from the passenger car manufacturers with largest market shares in Europe⁶. Altogether, manuals of 12 models of the requested 16 were received. The brands of these models enter into the 14 most registered brands in Europe covering around 63 % of the total new registrations in Europe in the year 2003⁷. Assuming that the brands have a uniform format for their user manuals, i.e. the manuals of the studied car models give a good picture of the other models of the brand as well the results from the survey of these 12 manuals illustrate well the state of manuals of new passenger cars in Europe.

User manuals of refrigerator-freezers were asked from the large manufacturers in Scandinavia, and 6 manuals were received. The survey of the content of the manuals was then carried out based on these six manuals.

Samples of laundry detergents and all purpose cleaners represent the population of such products available in Finnish supermarkets at the time of the study. Overall we examined 15 brands of all purpose cleaners and 25 brands of laundry detergents. This represents around half of the total population in Finnish markets. The products were selected in such a way that the proportion of the sample elements possessing a certain characteristic is approximately the same as the proportion of the elements demonstrating this character in the population, which allows generalizations to be made among the whole product population (Gilbert & Churchill 1995, 583).

Table 3. Samples of laundry detergents and all purpose cleaners

LAUNDRY DETERGENTS sample N = 25	ALL PURPOSE CLEANERS sample n = 15
<ul style="list-style-type: none"> ■ 19 powder detergents – 6 liquid detergents ■ 24 primarily for washing machine – 1 hand wash ■ 12 international brands – 13 less exported brands ■ 5 ecolabeled – 20 not ecolabeled 	<ul style="list-style-type: none"> ■ 9 international brands – 6 local ■ 7 ecolabeled – 8 not ecolabeled
Total population: 61	Total population: 31

For paper products such as envelopes, it was convinced by the feedback group of papers, that the environmental use of such products is not ad-

⁶ Based on the new passenger car registrations in Europe by manufacturer 2003 (ACEA 2004).

Largest manufacturers in terms of new registered passenger cars: VW Group, PSA Group, Japanese, Ford Group, GM Group, FIAT Group, DaimlerChrysler and BMW group (ACEA 2004).

⁷ Based on the ACEA statistics: New passenger car registrations in Europe by manufacturer 2003.

vised in the product itself. Therefore, it was better to focus on considering the institutions that are active or could be active on advising about collection and recycling of paper products, printing paper, newspaper and envelopes.

For textiles, an assumption was made based on the feedback group discussion that cotton, woolen, and silk garments, as well as other textiles, are usually instructed only in terms of washing declarations. In addition, the group of textiles is extremely large and heterogeneous assortment to carry out an extensive product survey.

The feedback group for furniture also stated that in many cases the instructions for use of sofa do not exist, or are not given unless the consumer asks for them. However, the instructions for use of sofa were asked from six large sofa retailers in Finland but were received only from two manufacturers.

3.5 Research Process and Data Sources

Data collection for the study began in October 2003. Issues of consumer information and sustainable consumption were studied and the key stakeholders in elaboration and delivery of consumer information were identified. The existing research work concerning environmental aspects of products and instructions for use was reviewed, as well as the guidance about formulating instructions for use. In addition to periodicals, newsletters and statistics sources, the main environmental and business on-line databases with links to over hundreds of other data sources were used. These included databases of Finnish Environment Institute, Helsinki School of Economics, Helsinki University, Finnish Statistical Centre and also some other international databases such as ScienceDirect. Also papers provided by European Environmental Agency (EEA) and Environmental Protection Agency (EPA) as well as data from other large organizations such as departments of United Nations and OECD were used as data sources. A general pattern was that the same information was found over again from different sources.

During the literature review phase, also the feedback groups for each product groups were formulated and the participants contacted. The common criteria for assessment of instructions were examined from the basis of existing instructions for use, eco-label criteria and legal regulations. The different standards and directives played an important role in data collection. The preliminary criteria for assessing environmental information in instructions for use was then set up and sent to the members of the feedback groups for preliminary examination, after which the criteria was agreed upon and modified in group discussions with the feedback groups for each product group. The six group discussions took place dur-

ing the December, 2003 and January, 2004 in the Finnish Environment Institute (SYKE), Helsinki.

After setting up the criteria for assessing the instructions for use, the survey of the instructions was carried out, focusing on cars, refrigerator-freezers, all purpose cleaners and laundry detergents. After this the empirical data was assessed and compared with other findings. Also the extend to which the empirical data could be generalized was evaluated. The last phase carried out in April and May, 2004 focused on elaborating proposals for further actions and writing the report.

4. Results

4.1 Environmental Aspects of Passenger Cars

Cars contribute to the climate change in terms of increase in carbon dioxide discharges and acceleration of the greenhouse effect. Another global environmental problem is the depletion of natural resources. In addition, air and soil pollution through NO_x emissions, acid rain and chemicals cause subsequent regional impacts on human health and ecosystems. Further, cars have their local environmental aspects in terms of degradation of air quality and nuisance of noise.

Exposure to pollutants may cause serious health threats. Not only is the visible smog in large cities but also the fine particles (PM_x) discovered to cause human disease. For example, long term exposure of adults to air pollution from motor vehicles causes about 80,000 deaths a year in Europe (WHO 1998). Another human-related environmental impact especially in the urban areas is the noise from vehicles. Levels higher than 65 dB is detrimental to health but still noise of this level and even above are being recorded in many countries. In addition, in European OECD countries, about 30 % of the population is exposed to noise levels above 55 dB. (OECD 2001, 175.)

Finally, at the end of its life cycle, the motor vehicle, containing metals, glass, plastics, tires, oils and other chemicals, is discarded as waste. Annually, some 50 million vehicles are scrapped in OECD countries (OECD 2001, 175) and around 59 million new vehicles are manufactured worldwide (NAFTA 2002). This represents a huge consumption of resources to construct new vehicles, and millions of tons of waste is a potential source of air, soil and groundwater contamination. The environmental aspects and impacts of cars are illustrated in figure 2.

Figure 2. Environmental aspects and impacts of cars

4.1.1 Energy Consumption and CO₂–emissions of Cars

As much as 90 % of the CO₂ emissions produced during the life cycle of a passenger car is generated in the use phase (Autoalantieto 2004). CO₂ emissions are caused by the fuel consumption of the vehicle. Burning one liter of gasoline generates on average 2 350 g of carbon hydroxide and the corresponding rate for diesel is around 2 660 g of carbon hydroxide (Ekoake 2003, 5). Therefore an effective means to contribute the emissions is to pay attention to the fuel economy.

The role of passenger cars as a source of CO₂ emissions is widely recognized and also user manuals pay attention to advising on how to reduce fuel consumption. Based on the instructions for use of cars it was found that personal driving behavior, conditions of use and technical conditions of the vehicle are the main aspects contributing to the fuel consumption and CO₂ emissions.

Personal driving style

Depending on the personal driving style, fuel consumption may vary even more than 10 % for the same car. Fuel is consumed most in the acceleration phase and when driving at top speeds. In addition to excessive fuel consumption, aggressive braking and re-accelerating wear out the tires and brakes. It is more energy efficient to brake with the engine than continuously push the brake pedal; especially new vehicles with the latest

technology do not need energy at all in engine braking (Motiva 2004). Monitoring the traffic far ahead, integrating several tasks and destinations to the same driving session, and planning the best driving routes in advance are all essential parts of eco-driving.

In many user manuals the highest possible gear while driving is recommended. For example, in stable conditions or down hill, the 5th gear can be used already in the speed of 60 km/h (Motiva 2004). The first gear should be used only for starting, and after driven the length of one vehicle the gear should be shifted to the next. Fuel consumption reduction can be achieved by driving with only 2/3 of the top speed of the gear shifting it to the next highest gear latest at the level of 2000 revs⁸. In the vehicle with automatic gearbox, the accelerator should be pushed carefully and not directly to the kick down position (VW 2003). After speeding up, the stable driving speed is essential. In the speed of 80 km/h, fuel consumption is moderate but above it rises substantially (Motiva 2004).

Idling is one means to increase fuel consumption, emissions and noise. In every situation idling should be avoided. Already after 30 – 40 seconds engine stop the amount of fuel saved is greater than the amount of fuel needed to re-start the engine (VW 2003). A careful and slow acceleration after start is better for warming the engine than idling.

Driving conditions

In addition to driving style, individual driving and traffic conditions contribute to fuel consumption. Much of the unnecessary consumption is due to rush hours. Continuous stops and re-starts, accelerations and braking in a traffic jam consume a lot more than stable driving with no hurry. In densely populated areas the worst traffics jams could be relieved if more people would change their driving time for 15 – 30 minutes earlier or later, and use optional routes. Fuel consumption with a new car on one kilometer's trip in flexible traffic is around 6 l / 100 km and during a busy hour consumption increases 70 % being over 10 l / 100 km due to three extra stops (Motiva 2004). Fuel consumption increases also in hilly geographic, and with additional air resistance such as when pulling a trailer, or when driving in a cold outdoor temperature.

Avoiding short trips saves fuel. Directly after start the cold engine consumes between 30 and 40 liters of fuel per 100 km and the consumption decreases to 20 liters per 100 km after a further kilometer. But it is not until after four kilometers driving from the start that the engine and catalytic converter reach their proper operating temperature and the fuel consumption becomes normal. (VW 2003.) If the vehicle is continuously used only for short distance driving (5-8 km) the average consumption is 60 – 80 % more than normally (Saab 2003). In reality, the distances

8) If there is no revs indicator available in the car, it should be accelerated to the speed of 10 – 15 km/h with the first gear, 40 km/h with the second gear, 60 km/h with the third gear, and 4th and 5th gear in speeds above 60 km/h (Motiva 2004).

driven are usually less than 8 kilometers. For example, in Finland, one third of car trips are less than three kilometers (Opus 2004) and thus these trips would be easy to do by biking or walking.

Driving in cold temperature consumes fuel remarkably more than in warm temperature. The use of engine heater reduces fuel consumption and emissions and it is beneficial for the engine (Figure 3). A recent study indicates that in the temperature of -20°C a pre-heated engine consumes 44 % less fuel compared to a non-heated engine. If the vehicle is started three times a day during the winter time, a pre-heated engine consumes even 80 liters less fuel than non-heated. This contributes directly to the CO_2 emissions and furthermore to the fuel expenses. Pre-heated engine saves around 0,2 – 0,3 liters of gasoline per start. (Motiva 2004.)

Figure 3. Savings due to pre-heated engine in the first kilometres from start (Motiva 2004.)

It is important that the engine heater is not used over time. Over two hours heating consumes electricity more than the benefits are. The inside space heater is not recommended since it is not necessary for the proper functioning of the vehicle, and it consumes electricity around 700 – 1800 W (twice as much as an engine heater), being on the days of use one of the largest electricity consumers in household. When the temperature is below $+5^{\circ}$ it is recommended to use the engine heater⁹ according to the following scale:

Table 4. Time for engine heater in different temperatures (Motiva 2004)

⁹ In new vehicles with the latest technology the engine heater may not be used if a radiation heater is already installed in the engine. Radiation heater heats the engine while the block heater heats the coolant. It is recommended to ask the manufacture which type of engine heater is suitable for certain vehicle. (Feedback group for cars 2003.)

OUTDOOR TEMPERATURE	HEATING TIME	
	Block heater	Radiation heater
+5°C ... -5°C	0,5 hours	1 hours
-5°C ... -10°C	1 hours	2 hours
-10°C ... -20°C	2 hours	3 hours

Additional air resistance increases fuel consumption. Key issues are the load of the vehicle and correct tire pressure. If the tire pressure is 0,5 bar too low, fuel consumption increases 5 % and also wheel damage may occur (Motiva 2004). 10 % too low tire pressures reduce the life time of tires by one fifth (Vianor 2004). It is recommended to check pressures from cold tires at least once a month, and every time when extra load is carried. Winter tires increase energy consumption even 10 % and they should be changed to the regular ones in spring on time.

Carrying extra load increases energy consumption around 1 l / 100 km depending on the weight (Motiva 2004). For example a car rack, even though it is empty, increases fuel consumption 12 % at the speed of 100 – 120 km/h (VW 2003) and 160 kg of extra load causes around 20-30 euros extra costs in a 5000 km travel (Motiva 2004). In addition, pulling a trailer as well as driving with open windows increase fuel consumption.

Technical conditions of the vehicle

Wrong technical adjustments increase fuel consumption and emissions. A vehicle that is maintained and served properly consumes generally 0,25 l less fuel than non-served vehicle (Motiva 2004) and a badly tuned engine may consume even 10 % more fuel than regularly maintained (VW 2003). Consumption can be reduced also by using high lubricity oils (Audi 2003, 267). The amount of oil should be checked regularly, as well as the ground underneath the vehicle to monitor that there are no oil spills. Repairs should always be done by a professional repair service, according to the instructions of the manufacturer and using only vehicle specific spare parts.

In addition, small electricity appliances, such as window and seat heaters, should be turned off immediately when not needed anymore. Air conditioning increases fuel consumption around 0,5 – 1 l / 100 km (Motiva 2004) and therefore it should be used only when needed. However, the appliance should be switched on at least twice a month for few minutes to guarantee the proper functioning of the device. In addition, dampness and frost should be carefully removed from the air ventilation system. (Feedback group for cars 2003.)

Monitoring fuel consumption is fairly easy in vehicles with a driving computer showing the consumption. But also with older cars it is possible to follow fuel consumption by writing down the kilometers when filling up. It is also worth controlling the revs during the drive so that too high revs are avoided. The main aspects contributing to the fuel economy and CO₂ emissions are presented in table 5.

Table 5. Aspects contributing to fuel economy and CO₂ –emissions of cars

ASPECTS CONTRIBUTING TO FUEL ECONOMY AND CO ₂ EMISSIONS	Issues increasing fuel consumption and CO ₂ emissions	Actions improving the fuel economy and reducing of CO ₂ emissions
DRIVING STYLE	Aggressive driving style at unstable speed with continuous accelerations and braking.	Fast speeding up and then stable driving by using only 2/3 of the top speed of the gear and favoring engine braking.
	Driving at top speed.	Lower driving speeds; ¾ of the top speed splits the fuel consumption.
	Idling the car.	Turning off the engine during longer breaks in the traffic flow.
	Ignorance of fuel economy.	Regularly monitoring the average fuel consumption.
CONDITIONS OF USE	Low temperature.	Engine heater (when < +5).
	Traffic jam and city traffic.	Planning the route and driving time, and foreseeing the traffic conditions.
	Short trips (< 5-8 km).	Preferring walking and public transport.
	Incorrect tire pressures.	Measuring tire pressures minimum once a month.
	Gravel and hilly geographic.	Driving on roads that are in good condition.
	Air resistance from extra load e.g. car rack or trailer.	Removing extra load immediately when not needed anymore.
	Open windows.	Closing windows before driving.
	Winter tires.	Changing winter tires to the regular ones on time.
	Wide and low tires.	Using regular size tires.
TECHNICAL CONDITIONS OF THE CAR	Ignorance of regular services and car care.	Regularly servicing the car and controlling the oil and other fluid levels.
	'Do it your self' principle.	Following the instructions of the manufacturer, using high quality service and original vehicle specific spare parts.
	Electrical appliances.	Switching off small electrical appliances such as window and seat heater when no longer needed.
	Air conditioning.	Using air conditioner moderately, only when needed. However, switching it on twice a month to ensure proper functioning.

4.1.2 Emissions of NO_x, CO, VOC and Fine Particles from Cars

In many cities the concentration of harmful emissions rises above the acceptable levels. Carbon monoxide (CO), carbon dioxide (CO₂), nitrogen oxides (NO_x), particulate matter (PM), lead (Pb) and volatile organic compounds (VOC) are the main pollutants emitted (Table 6). (OECD 2001, 172.) Although the engine technology, such as catalyst, has substantially decreased the emissions from passenger cars, the individual conditions of use, such as cold climate, may set some drawbacks to the emission reductions. For example, emissions from the newest vehicles during the first driving kilometers after a cold-start may be as high as emissions from old cars since the catalytic converter is less effective immediately after start, although after minutes drive the emissions from new cars have declined (Motiva 2004). Thus, the significance of engine heater

is highlighted in order to lessen emissions from cold-starting. If the engine heater is used in -15° temperature, CO emissions decline for 65 %, CH for 45 % and NO_x for 12 % (Adato Energia 2001, 8).

Other means to prevent emissions is to take care of the correct technical adjustments of the vehicle and to use high quality engine oils. Repairs should always get done in a professional car dealer and vehicle specific spare parts should be used. In addition, idling should always be avoided.

Table 6. Emissions of road traffic.

Source: Autoalan faktat 1998 ; Toyota European Environmental Report 2001, 21.

AIR POLLUTANT	ENVIRONMENTAL IMPACT	ACTIONS INCREASING POLLUTANTS
Carbon monoxide (CO) produced by the incomplete combustion of fuel.	Contribution to human health and photochemical smog	Unstable speed with accelerations and braking, cold-starting, driving in busy traffic
Hydrocarbons (HC)	Contribution to the tropospheric ozone formation	Unstable speed, acceleration and braking, cold-starting and driving in busy traffic
Nitrogen oxides (NO_x) formed by the reaction between oxygen and nitrogen contained in the intake air.	Contribution to the acid rain, smog and tropospheric ozone	Fast driving, accelerations and vehicles without catalyst
Particulate matters (PM) from combustion.	Health effects	Non-serviced vehicles
Carbon hydroxide (CO_2)	Contribute to climate change	Consumption of fuel

4.1.3 Life Time of Cars

In the 15 EU countries, the average age of car fleet varies greatly, with the highest ages in Norway and Finland with over 10 years old car fleet, Sweden 9,7 years and Denmark with 8,4 average life time of a car fleet (Bil- og veistatistikk 2002). In addition, there are a number of cars exceeding the age of 20 years still in use. For example, in Norway, 6,2 % of the car fleet is over 20 years old (Statistics Norway 2002) and in Finland the average age of abandoned cars is 18 years (Tieliikenne Suomessa 2004). Usually older vehicles consume more energy and generate more emissions than their younger counterparts but on the other hand, fast replacement of the car fleet leads to the over consumption of materials and increase in waste. Overall, as long as the environmental performance of the older fleet of vehicles does not differ too much from the newest technology, the older vehicle is worth sustaining by extending its life time (EEA 2001). It can also be recommended that older vehicles are used in less intensive or part time e.g. 'summer cars'.

Preventing corrosion on the bodywork and the underside of the vehicle is of key importance. The threatening factors are bird droppings, insects, tree resin, industrial grime, tar spots, soot, oil, road salt, high temperatures and marine climate. The longer these harmful substances remain on the paintwork the more damaging the effect is, leading finally to corrosion of the bodywork. A lot has been done in terms of materials and structure of the vehicle so that a new car is better constructed against

corrosion than earlier, and manufacturers commonly give a guarantee of several years to the bodywork. However, this guarantee is limited and will be affected only if the corrosion has started from the inner space of the car. Thus, the defects in the paintwork and underside of the vehicle are on the owner's responsibility and this can make the prevention of corrosion problematic for the owner.

Inspections indicate that severe corrosion has been found in many cars only 3 – 5 years age and often it is the underside that is severely corroded (Puukka 2004). Thus, the additional corrosion treatments seem to be needed but they can be in contradiction with the terms and conditions of the guarantee. In user manuals the additional self made corrosion treatments are not recommended since the treatment substances easily gather to the air-discharge holes in the underside and block the air ventilation and preventing moisture coming out from the bodywork, which may even foster the corrosion inside (Feedback group for cars 2003).

It is clear that these additional treatments have to be done in specialized dealers that are professional in this work. This is important, since the guarantee of the bodywork can be lost if the underside has not been treated according to the instructions of the manufacturer. In order to promote additional corrosion treatments, manufacturers could describe the methods and materials accepted for the treatment, and give this information in the user manual, and also have a list of approved corrosion treatment companies.

Preventing defects in the paintwork is another issue that can be contradictory to the owner. The best result can be gained by manual waxing but it is uncertain how different waxing products stand the automatic machine washing. Waxing can also be done in the machine wash but the quality and durability of this wax vary a lot. Therefore, the manual waxing is recommended in addition to the wax in washing machines. (Feedback group for cars, 2003.) User manuals do not give any common rule to the frequency of manual waxing or machine wax but the most common rule seems to be, however, to do the manual waxing at least twice a year, in the spring and fall term. In addition to this, some of the instructions recommend that waxing should be done at the latest when water on the clean surface does not gather to small drops and roll off. Waxing should always be done according to the manufacturer's instructions so that the wax does not block the spray pipes of the window cleaner, or harm other materials of the vehicle.

Daily tasks against corrosion include frequent washing of the bodywork and underside especially if it is continuously driven in maritime climate, or on salty roads. In this case, washing is recommended weekly. In other conditions monthly washing and appropriate waxing may be sufficient. The underbody of the vehicle should be washed at least in the spring, after the winter time. Defects such as bird droppings, oils, tree resin and other spots should be washed immediately and small defects in

the paintworks repaired according to the manufacturers instructions, since the small scratches in the paintwork serve as a potential ground for corrosion. (Feedback group for cars 2003.)

In addition to substances, also a car blanket may cause damages to the paintwork and thus is not recommended to use. If the blanket is, however, used, the surface and the blanket must be clean, and the blanket must suit the vehicle without causing scratches. Parking in direct sunlight is not recommended either, since high temperatures and direct sunlight intensify the corrosive effect. Corrosion can be protected also with proper ventilation of the car, assembling mud flaps, and monitoring the bodywork and underbody of the vehicle regularly and making corrections accordingly. (Feedback group for cars 2003.)

Technical conditions of the vehicle effect the life time in many ways. Good condition of the engine can be sustained by stable driving style avoiding aggressive accelerations, kick downs and high revs. The engine heater is once again a valuable appliance when the temperature decreases below $+5^{\circ}$. Only one cold-start in minus 15 – 20 temperature wears out the engine as much as 500 – 600 km drive (Välimäki 2001). However, heating more than 2 hours will decrease the function of radiator fluid and consume electricity unnecessarily, and thus the timer is recommended.

The quality of the engine oil contributes in the long run to the engine conditions and therefore it is recommended to use oil qualities that are favored by the manufacturer. Additional substances to oil and gasoline are not recommended (Feedback group for cars 2003). Oil change is also better to carry out in the manufacturer's dealer rather than by self service. Regular maintenance operations are essential in order to longer the vehicle's life time and in addition, checking of engine oil and other fluids should be done frequently, for example when filling up.

Battery is one of the appliances that may loose its proper function if not treated carefully. In the newest vehicles the battery is in many cases service free and needs special attention only in case the vehicle is out of use for a while. In older vehicles, however, the battery needs special attention. It should be kept clean and dry, and the oxides should be removed from the poles. (Autoliitto 2003.) It must be noticed that small electrical appliances such seat heater, emergency blinker, or lamp may discharge the battery within a few days and thus the small appliances should be switched off when no longer needed. If the battery runs down many times, this shortens its life time. (Feedback group for cars 2003.)

Driving in special conditions may cause extra burden to the vehicle. For example, when pulling a trailer, or running-in, the vehicle may need special treatment such as more frequent maintenance, or more careful driving. Especially, the running-in drive, i.e. the first 1000 – 1500 kilometers should be done carefully since it affects in considerable extend to the way the vehicle will function afterwards. Special treatments are

needed also if the vehicle is not used for a while e.g. in case of 'summer cars'.

Table 7. Issues contributing to the life time of a passenger car

SHORTENING THE LIFE TIME	PROLONGING THE LIFE TIME
Corrosion and defects in paintwork	
Bird droppings, insects, tree resin, road and industrial grime, tar spots, soot, road salt, oil spills, high temperatures and direct sunlight.	Regular washing and immediate removal of harmful spots and dirt. Waxing depending on the use and road conditions, but at least twice a year. Washing the underside of a vehicle monthly if driven on salty roads or near the coast, but at least once a year after the winter period. Not parking under trees, on the grass or direct sunlight. Monitoring the surface and protective layer regularly and using additional corrosion treatment according to the instructions of the manufacturer. Removing snow before placing the car in the garage. Placing mud flaps to the vehicle. Keeping distance 30 cm or more to the surface when washing with high pressure. Taking care of the regular air ventilation in the car and in the garage. Not using the heater of indoor space more than 2 hours.
Damages in paintwork	Never using a dry cloth or removing dirt, mud or dust from dry surface. Not using a blanket as a cover. Repairing the mechanical scratches on the paintwork immediately.
Technical conditions of the vehicle	
Improper engine conditions	Regular servicing according to the manufacturer's instructions. Regular monitoring of oil and other fluids, and the ground underneath the vehicle. Using high quality engine oils recommended by the manufacturer and getting the oil change in a manufacturer's dealer service. Not using any additives in motor oil (if not specifically recommended). Using engine heater (not more than 2 h) when the temperature is below +5°. Checking the antifreezes of the radiator in the fall.
Aggressive braking	Avoiding continuous accelerations and braking.
Improper battery conditions	Checking the charge and acid level after 20 000 km or every two years. Keeping the battery dry and clean and removing oxides from the cables. Protecting the battery against frosting and noticing that an uncharged battery freezes already in -10° temperature and fully charged battery in -70°. Waiting few minutes before restart. Avoiding actions that could discharge the battery such as leaving small electricity appliances on. Following extra caution with the battery and not causing short-circuit by any tools.
Improper use and care of tires	Checking the tire pressures in two weeks frequency or monthly. Avoiding aggressive braking especially with new winter tires. Monitoring tires from damages from time to time. Avoiding driving over curbs and obstacles. Protecting tires from grease, oil and fuel. Replacing missing dust caps soonest. Confirming the correct rotation direction when assembling the tires. Washing and storing the tires in dry and cool place out of direct sunlight. Storing the tires hung up or on one's side.
Improper spare parts and servicing	Using only original and vehicle model specific spare parts. Servicing regularly and favoring professional service dealers.
Special conditions	
Long term lay down	Asking special instructions, if the vehicle is shut down for a long time. For example, disconnecting the negative pole is not used for 4 weeks etc.
Winter use	Checking and adding antifreezes such as frost proof windscreen washing fluids in the fall, and oiling the locks before winter.
Pulling trailer	Following the instructions of the manufacture about pulling the trailer.
Improper running-in	Driving the first 1000 –1500 km with special care.
Towing	Carefully following the instructions for towing.

4.1.4 Wash and Care of Cars

Car wash operation consumes water and is a potential source of soil and groundwater contamination due to the chemicals from car care products and tool cleaning (Table 8). The vehicle should not be washed in places where waste water flows directly to the environment. Thus, in many

cases, car wash is directed by local regulations. For example in Helsinki, car wash in own yard is regulated by allowing only occasional washing and the use of mild cleaners. Special washing places where waste water is collected and recycled are recommended as well as environmentally labeled car care products. Solvents should only be used for strong dust. Especially, when washing the engine, oil and grease will mix the waste water, and therefore the engine should be washed only in places specific to the purpose, for example, in the filling station or the manufacturer's dealer.

Table 8. Environmental aspects of car wash and ecologically sound forms of action

ASPECTS OF CAR WASH	ECOLOGICALLY SOUND ACTIONS
Consumption of resources	Washing the vehicle only when needed. Using water moderately and with cool temperature (not above +35°).
Waste water	Washing the vehicle in specially provided washing places. Favoring washing places that collect and recycle the water.
Chemicals (cleaners, grease removers, waxes and polishes)	Using environmentally labeled car care products. Using solvents only for strong dust.
Packages and cloths	Delivering oiled cloths and containers of harmful chemicals to the collection of hazardous waste. Never placing containers of hazardous chemicals to the household waste or spill chemicals down the drain.

4.1.5 Noise of Cars

In the European OECD countries around 30 % of the population is exposed to noise that exceeds the acceptable maximum level of 55 dB (OECD 2001, 175). In addition to the health effect, noise reduces comfortableness and ability to communicate (Table 9). Therefore, especially close to living centers, unnecessary noise should be avoided by moderate driving behavior. Noise increases when driven with high speeds, or idling. Also hard accelerations and wide tires rise the noise level. The engine heater should be used in winter time. Especially in the countries with winter climate, noise levels are higher than in warmer conditions. Noise emissions from small family cars in the winter conditions are much higher (74dB) than acceptable, but in warmer countries the results may be totally different for the same cars (Ketonen 2003, 79).

Table 9. Preventive actions against nuisance of noise from the vehicles

NUISANCE OF NOISE	PREVENTIVE ACTIONS
Inconvenience Disturbance to communication Disturbance to concentration and sleep Detriment to health (65 dB)	Avoiding idling and unnecessary driving. Moving on after starting immediately when possible. Avoiding top speeds and hard accelerations. Using engine heater. Using regular size wheels. Changing winter tires to the regular ones on time. Using the caution signal only when informing about danger.

4.1.6 Disposal of Chemicals and Parts of Cars

Every year, end-of-life vehicles in the EU area generate between 8 and 9 million tones of waste, which must be treated properly. To reduce the amount of waste the Directive on end-of-life vehicles requires that vehicles coming on the market after 1 January 2005 should be reusable and/or recyclable to a minimum of 85 % and reusable and/or recoverable to a minimum of 95 %, both in terms of weight per vehicle (EEA 2001, 2), and that the last owner can deliver the end-of life vehicle to an authorized treatment facility without any cost. (EU 2000.)

However, while the directive has not been in effect, a lot of vehicles has been abandoned illegally to the environment. In many of the EU countries this illegal discarding of end-of-life vehicles is assumed to account for 7 % of the end-of-life vehicles (Collins et al. 2002, 8). This poses a contamination threat to the environment due to the harmful materials and their release.

Vehicle consists of a number of different materials, many of which are classified as dangerous substances (Figure 4). Batteries containing lead and sulphuric acid are dangerous not only to human health but to the environment as well. In addition, catalytic converters contain a combination of metals, aluminum, ceria and other oxides. The major source of contamination from abandoned vehicles is also the operating fluids, such as oils, hydraulic fluids, radiator coolant, brake fluids and fuel. Hazardous wastes such as waste oil and solid filters and cloths, brake, clutch and cooler fluids and antifreezes should be treated carefully by collecting them to separately into tight containers without mixing the substances together and then delivering to the contractor for recovery or disposal instead of delivering the chemicals to the environment. (Collins et al. 2002, 8-9.)

Figure 4. Average composition of a car
(Modified from Collins et al. 2002, 8)

Inappropriate management of waste oil can lead to the pollution of soil and water. Changing the engine oil and oil filter is one of the most common operations that the car owners do by themselves. With careful estimation, self changed engine oil accounts for one fourth of the oil changes. For example, if the car fleet consists of 2 million vehicles, including on average 3,5 liter engine oil per vehicle and the oil is changed minimum once a year, this requires 7 million liters of oil, 1,75 million liters of which is changed by the owners. There is no certainty about where this waste oil ends up but the potential oil waste is excessive. In addition to the waste oil, the filter contains around 0,1 liters of oil ending up to the environment if the filter is thrown away among household waste. (Nissan Environmental Program 1996, 6.)

4.1.7 Environmental Information in User Manuals of Cars and Best Practices

Environmental aspects of cars include energy consumption, length of life time, chemicals, emissions, noise and solid waste. Environmentally sound driving (eco-driving) is the main factor contributing to fuel consumption, including such issues as planning the drive, driving style, pre-heating the engine, air resistance and air conditioning (Appendix 1A). At the same time, these issues contribute to noise and emissions of the vehicle. Corrosion prevention and proper maintenance and care are on the other hand main factors contributing to the life time of a vehicle (Appendices 1B-

1C). Finally, disposal of parts and fluids is a potential source of waste water, soil degradation and solid waste (Appendix 1D).

Best practices in delivering environmental information of use include of course, the principle that all the relevant environmental aspects are dealt with. In addition, the way the advice and background information is presented is important (Appendix 1E). Best practices for passenger car were selected from the user manuals regarding these important environmental aspects, i.e. fuel consumption, prolongation of life time and disposal of chemicals and parts. None of the studied user manuals alone could be used as example of best practice, but a combination of good points from the 12 examined manuals is presented.

Environmentally sound driving style is instructed in all manuals. However, great varieties exist in the presentation of this information. Although the consumption of fuel in different conditions e.g. in road, heavy traffic and combined drive, is shown in most of the manuals, a good solution would be to clearly summarize the conditions and facts that increase fuel consumption and also repeat them in the relevant passages of the text. It would also be encouraging to present fuel savings in quantities (liters of fuel saved) if the specific instructions were followed. Although some justifications exist in many of the manuals, only few manuals succeed to convince the user about the importance of eco-advice.

A good example of the instructions of environmentally sound drive is given in Volkswagen (VW) user manual where the section 'Driving economically and with respect for the environment' provides the driver with 10 tips of fuel savings. These tips are clearly presented, containing also thorough justifications why these instructions are important. Also Toyota manual provides the user with 15 separate instructions on how to save fuel and prolong the vehicle's life time. Users are motivated to read the instructions by appealing to the savings gained by only small efforts on daily use.

The importance of correct tire pressures in fuel economy is highlighted in all manuals as well as the correct use of air conditioner. However, the high energy consumption of air conditioner could be stressed more. In addition, the influence of width tires, or winter tires, to fuel consumption could be given more attention to.

Winter drive is a Northern 'specialty' and requires specific instructions such as how to use the engine pre-heater. Only one manual mentions the usefulness of engine heater in winter conditions, although it is obvious that cold starting consumes high amounts of fuel already at moderate temperature, not to mention the consumption at freezing temperatures. Half of the manuals provide a list of issues that should be paid attention to before and during the winter time. Other manuals include, however, individual instructions for example, for battery, windows and locks, but for the reader a through list of instructions to be followed before and during the winter time would be helpful.

Winter drive and other special conditions have their influence to the length of life time and also to the level of fuel consumption and release of emissions. Also partly due to the winter time it is common in Northern countries that some vehicles such as convertibles and some old vehicles e.g. 'summer cars' are laid down for around half a year, and many instructions could be useful to prepare the vehicle for this lay down period. This kind of advice is only instructed in two of the manuals and one manual encourages users to ask manufacturer for special advice for lay down.

One good example is Opel manual, where instructions for both the lay down and taking the vehicle back in use are given. Good points exist also in Saab manual, where winter drive and long term storage are instructed. These instructions contain 10 important advices for 3-4 months lay down. In addition, consumption of fuel of cold engine is illustrated by clear quantitative data and justifications. Finally, the use of engine heater is recommended. Good advice on the winter care is also in Toyota user manual where the driver is reminded of special tasks that should be checked before winter time, including 8 tips for winter drive, emphasized with bold typeface.

Factors contributing to the life time of cars include regular care and maintenance as well as prevention of corrosion. Overall, corrosion prevention is instructed well in the manuals, although the information is clearly presented only in 5 manuals. This means that in these 5 manuals the factors that are threatening to the bodywork and cause corrosion are listed. Also operations to prevent corrosion and damage are summarized. Good examples are Toyota, Nissan and Volvo manuals where the corrosive factors are explained in detail, and also comprehensive corrosion prevention is advised by using active voice and bold typeface to illustrate the most important points. In addition, Mazda manual provides a thorough list of threatening factors to the vehicle and instructs how to prevent impacts of these factors. Also a necessary list is given in Peugeot manual where the extreme conditions that heavily load the vehicle, are summarized.

Correct wash and care practices is also a part of corrosion prevention. These instructions vary a lot in the manuals. The best washing instructions are given for different materials of the vehicle, and detailed data about washing manners and chemicals that should or should not be used, is included. These kinds of instructions are found for example in Volvo and Audi user manuals. Also a suitable cleaning agent type is mentioned for all materials. In addition, an important issue is the washing place, which is rarely mentioned in the manuals. A good example is, however, Ford manual that recommends to use environmentally sound car wash that circle the water. Also a list of preferable care products is given, although the environmental soundness of these products is being assured only by the manufacturer.

All the manuals underline the importance of regular servicing and maintenance operations. Sometimes, however, it may be confusing to the user what the regular care means and whether there are operations that should be done more often than in the annual servicing. Nissan user manual is a good example of instructing about the frequency of regular servicing and in addition, presents a list of items that the user should check regularly. The good point is that the most important checks are gathered on one page, so that it is easy to follow what has to be checked and monitored, and how often. Also Ford manual encourages users to do regular checks by categorizing the issues under daily inspections, checks in connection to filling up the tank, and monthly inspections. Regular checking is well reminded also in Volvo manual where the list is easily available in the back cover of the manual.

All the manuals explain the meaning of warning lamps of the instrument panel and also give instructions on operations that the users could do by themselves. However, there are great differences on how the information is presented. A good example is Toyota manual where the reader is provided with thorough instructions about 'do-it-yourself' operations. Additionally, this manual gives a list of issues that the user should monitor and recognize, e.g. unordinary noise or changes in the functioning of the vehicle. Also, possible reasons and solutions for the fault are given.

In most manuals, disposal is advised in a less meaningful way by stating that the parts and fluids should be discarded correctly. This enables the option that the user will not trouble to find the correct places where to discard the parts. A good example of disposal of parts is in Nissan user manual where the consumer is encouraged to deliver waste oil, filters and cloths to the local collection of hazardous waste or to the car dealer. In addition, consumers are encouraged to ask more information on disposal of materials from the dealer. The basis for these instructions is also justified by stating strict and clear environmental claims on the pollution potential of car parts. Another good example is Citroën user manual, where there is a separate chapter 'Recycling and environmentally soundness' where recycling and other information on materials of the vehicle are advised. A good advice on disposal of the vehicle is given in the Saab user manual where the basis of producers' responsibility and recycling of cars are explained continuing with the information on how the car owner is able to utilize this possibility when discarding the vehicle.

Best practices include, of course, presentation of general information on environmental related issues. A good example is Mercedes-Benz (MB) manual where the impacts of CO₂ emissions of passenger cars to global warming are mentioned. This is informed in the section where technical data and fuel consumption in different conditions are presented.

The presentation (e.g. colors, figures and symbols) of the environmental instructions differs a lot in the manuals. A good example is Audi

manual where colors and green symbols are used to illustrate the most important points and to capture readers' attention. Instructions are also presented in a clear and easily readable way. In VW and Audi user manuals, the credibility of environmental claims are also improved by giving supportive data and figures, such as figures of the relation of fuel consumption and the speed as well as fuel consumption and engine temperature.

The thickness of manuals examined varies from 170 pages to 470 pages. In such thick manuals is important to place information so that it is easily observed and found. In MB manual the overview of environmental issues is presented already in the introduction pages. This page informs consumers about the basics of environmental sound driving behavior, and gives the motivation that environmental issues are important and they should be paid attention to. In addition, environmental concerns are completed and repeated as reminders later in the manual.

Another best practice of presentation is to gather the environmental information under one section such as in Audi manual 'Driving and Environment'. In addition, the important details are repeated in other parts of the instructions. This is especially important in case the user wants to skip the environmental section of the manual. Yet, a good example is VW manual that is divided into three separate books including 'technical data', 'controls and equipment' and 'tips and maintenance' parts. These three separate parts are easy to read, and they enable also relatively much environmental information to be included in each part.

Some kind of quick-guide attached to the thick manual is common. However, the environmental issues are lacking in these quick-guides and are presented only in the thick manual. The correlation between the thickness of the manual and the amount of environmental information was not examined, but as a clear example, Ford, Citroën and VW manuals provide relatively large amount of environmental information being small in size and containing around 200 - 250 pages while many of the manuals contain over 300 or even over 400 pages. Thus the good presentation of environmental issues in the manual does not necessarily lead to heavy manuals.

The current level of environmental instructions in user manuals is summarized in table 10. The more detailed list of instructions that could be given to the driver is shown in appendices 1A – 1E.

Table 10. Summary of environmental instructions in user manuals of cars

INFORMATION ON ENVIRONMENTAL ASPECTS OF CARS	GOOD	SUGGESTIONS FOR IMPROVEMENT
Energy consumption and CO ₂	<i>Planning and monitoring;</i> - High fuel consumption after start is stressed and driving short trips is discouraged. <i>Driving style;</i> - Tips for environmentally sound driving behavior are given. - Aggressive driving is discouraged. - Immediate drive after start is highlighted. - The use of correct (higher) gear is recommended. <i>Air resistance;</i> - Correct tire pressures are stressed.	<i>Engine pre-heating;</i> - Engine heater could be stressed, and its correct use instructed. - Fuel consumption after cold start and especially in winter time could be highlighted (with figures and quantitative data). <i>Driving style;</i> - Quantitative data and figures on impacts of economic driving style to fuel consumption could be given. - Fuel consumption in heavy traffic with several stops could be stressed more.
Life time	<i>Corrosion prevention;</i> - Threatening factors for the bodywork are explained and corrosion preventive advised. <i>Maintenance;</i> - The importance of regular and professional car servicing and model specific spare parts is stated. - Running-in is well advised.	<i>Maintenance and care;</i> - Instructions for lay down and short term storage (e.g. summer cars) could be given in more detail. - Threatening factors, extreme conditions of the car and how the influence of these factors could be prevented, could be summarized in all manuals.
Emissions of NO _x , CO, VOC and PM	- Harmful effect of CO is stressed. - Recommendations of oil and fuel qualities are given.	- The effect of pollutants to smog (tropospheric ozone formulation) could be given.
Wash and care practices	<i>Car wash;</i> - General advice on car wash is given. - Strong solvents are discouraged to be used.	<i>Car wash;</i> - Environmental aspects of car wash could be explained. - Eco-labeled car care products and environmentally preferable washing bays could be recommended.
Noise	- Many aspects effecting noise are mentioned when advising about environmentally sound driving.	- Sources of noise and extra noise could be explained and listed in the manual.
Disposal of vehicle, parts and chemicals	- Waste oil and other fluids, as well as battery, are advised to be treated properly.	- More information on the materials of the vehicle, recycling of these materials, and sources of harmful fluids could be given. - Disposal of fluids and parts could be informed in more detail, e.g. collection points for different fluids and parts.
Other	- Justifications for environmental claims are added.	- Information on the implications of cars to environment e.g. to the global warming and smog could be given.

4.1.8 Comments from the Feedback Group of Cars

Environmental soundness of a vehicle may have a limited effect on consumers when they are buying a car because of the high priority of other criteria such as price, the size of the vehicle, power, comfortableness, additional accessories and color. However, fuel efficiency and economical feasibility are becoming more important selection criteria and providing environmental information consistently in the purchase situation and afterwards is important.

A lot of data on ecological driving and efficient fuel economy already exist and thus the emphasis should be on efficient delivery of this information to consumers. The opinion of the feedback group was that although the environmental aspects would be instructed in the user manual, users often ignore the manual and the possible environmental benefits are not achieved. This leads also to other problems, such as improper driving and maintenance of the vehicle enabling unnecessary damages. Therefore the role of the seller is important in providing environmental information in the purchase situation e.g. explaining the importance of correct use and also introducing the basics of eco-driving when transferring the vehicle to the new owner.

Another problem related to the instructions for use is that the manufacturer formulates the user manuals to global markets and local conditions of one market area may not gain enough attention. For example, in Northern countries, driving conditions differ greatly from the conditions in Central and South Europe in terms of climate, temperature and road conditions. Thus, the instructions for use may not pay attention to these special conditions even though these would need special instructions. One example is the use of engine heater. Although many of the manuals stated that cold engine consumes more fuel than warm engine, the engine heater was recommended only in one manual.

One solution to the problems explained above could be a **'quick-guide'** on environmental issues (Figure 5). This guide could be general in nature, including instructions about efficient fuel economy and other environmental aspects with relevant adjustments to different types and ages of cars and to the country specific driving conditions. More detailed vehicle specific instructions could be found in the user manual. The quick-guide could be given to the new driver for example with the driver's license. For more experienced drivers the material could be available in the **service stations, inspection stations and other car dealers**. For a car buyer, likely the best way to get the quick-guide would be in the **purchase situation**.

Guide to environmentally sound driving and care of cars:

- Information about the role of passenger cars and traffic in global warming, and local air pollution problems
- Tips for environmentally sound driving behavior
 - planning and monitoring, accelerating, idling, braking
 - less noisy driving, avoiding short trips, etc..
- Facts about conditions that increase fuel consumption and emissions
 - cold engine, air resistance, air conditioning, tire pressures, road conditions, etc..
- Quantitative data on emission reductions, fuel consumption and economic savings due to the environmentally sound driving behavior and different conditions of use
- Advise and tips for prevention of corrosion and prolongation of life-time
- Regular maintenance operations, checking and servicing
- Instructions for winter care and other special conditions
- Instructions for disposal of bodywork, parts, fluids and car care products
- List of eco-labeled car care products
- Information on environmental sound car wash and washing places

Figure 5. Proposal for the 'quick-guide' on environmentally sound driving

Campaigns on environmentally sound driving are possible to implement in many places, especially in **TV, radio, newspapers and magazines** (Figure 6). For example, in fall or winter the importance and benefits of engine heater could be highlighted. In spring, washing off the road salt could be reminded, and in summer people could be encouraged to walk and bike. Such campaigns could be organized in co-operation with car manufacturers, car industrial associations, educational institutes, driving schools and other contributors.

Figure 6. Possible topics for seasonal campaigns to promote eco-driving

It is difficult to address one party whose duty the instructing of environmentally sound driving should be (Figure 7). The role of **car industrial associations** and **research institutes** is emphasized in providing the latest data on environmental issues of use of cars, which could be used to effect drivers' attitudes. Also arranging educational work shops for all interest groups is important. This includes education for **car sellers and people responsible for environmental affairs in different organizations**. For example, in many companies, the organization is committed to the different '**green**' and '**eco**' programs in their office work, and thus the environmentally sound driving could also be taken as part of the environmentally sound working habits, e.g. donating bikes or free travelers' tickets to employees, since the work traffic is likely one of the greatest reasons for daily drive. Also **driving schools** could take 'eco-driving' among the topics of theory lessons and a routine to the driving lessons.

Figure 7. Parties instructing environmentally sound use of vehicles

4.2 Environmental Aspects of Cold Appliances

Energy use, harmful substances and prolongation of life time are the environmental aspects that are assessed as the most important ones in the use phase of a refrigerator-freezer. A new cold appliance of 250 liters uses around 400 kWh electricity (€ 32) per year, while a 15 years old, inefficient appliance consumes around 1200 kWh (€ 96) per year (Energia.fi 2004). Replacing an old appliance with a new efficient model could save up to 800 kWh electricity and two thirds of money but will lead to increased disposal of old appliances. Therefore it is important to recognize the actions and circumstances that reduce energy consumption in daily use and help to sustain the appliance in a good condition.

Great energy benefits can be achieved by placing the refrigeration device to an environment with sufficient air circulation and temperature. Inefficient air circulation (Table 11) increases energy consumption 10 - 160 % (Hymonet 2004) and if the circulation is prevented totally, the amount of energy used will triple (TTS Institute & Motiva Ltd 2003). Insufficient ventilation impedes also the functioning of the appliance and may damage the compressor (Marjomaa 2003, 1). Also, placing the re-

frigerator-freezer close to a source of heat, such as oven or direct sunlight, can increase energy consumption between 10 - 20 %. In addition, if the temperature in the immediate surroundings of the appliance arises from +25° to +32° energy consumption could double and may also overload the compressor (TTS Institute & Motiva Ltd 2003).

Table 11. Relation of insufficient air circulation and electricity consumption (Reisbacka & Rytönen 2000, 4.)

Ventilation prohibited	behind the top closet	below the devise	from the top and below	FREE VENTILATION
Specific consumption 1,6 kWh/d
Increase in electricity consumption	10 %	100 %	160 %	0 %
Within a day	0,2 kWh	1,6 kWh	2,5 kWh	0 kWh
Within a year	73 kWh	584 kWh	913 kWh	0 kWh

Temperature inside the refrigerator-freezer is another issue effecting energy consumption. The recommended temperature for refrigerator is +5° and for freezer -18° (Helkama User Instructions 2003, 27). One degree of cooler air increases energy consumption by 5 % (TTS Institute & Motiva Ltd 2003).

It is important to make sure that the door seal is functioning well and the door is closed tightly. One way to test the door seal is to put a flashlight inside the fridge, turn out the kitchen lights, and check for light leading through the seal. In case the seal does not function well, it should be washed with mild dishwashing liquid or be replaced, if needed. Other tips for retaining stable temperature and low energy consumption include covering and pre-cooling the food before placing them into the freezer or refrigerator, and not opening and closing the door repeatedly. The pre-cooling of foodstuff prevents the release of moisture which could otherwise accelerate icing in the cabinet making the compressor to work harder and use more energy. In addition, foodstuff must be placed in the cabinet in a way that air circulation is not blocked under any conditions. Latest, the freezer must be defrosted after the frost is built up in the freezer more than 0,5 cm (Hymonet 2004). Even if the defrosting func-

tion is automatic, the hole of the drip channel should be checked and cleaned regularly, since if the hole gets blocked, water remains in the channel and runs into the bottom. When defrosting or cleaning the appliance, sharp items and electric parts should not be used as they may damage the refrigerating system. The deep-freeze switch should be used only for deep-freezing and if the function is not automatic, it should be switched off when not needed anymore. Dust may gather under the appliance and regular vacuum-cleaning is needed. Also the compressor and condensation pipes behind the fridge have to be cleaned around once a year (Helkama User Information 2003, 29, 30). The correct placing, cleaning, defrosting and other maintenance operations are important also in order to lower or keep the noise moderate.

Before 1995 the insulating material of refrigeration device contained CFC – compounds, i.e. freon, that acts as an accelerator in ozone depletion and greenhouse effect. Harmful compounds release due to the improper disposal, or a damage of an appliance. To avoid solid waste production and to prevent the release of the heat transmission material, disposal of appliances must be done appropriately, according to the local regulations. Even though CFC –compounds are no more used as insulation, there are still thousands of old refrigerators and freezers in use.

In many cases the economical aspect may serve as an incentive towards more environmentally sound thinking in households' behavior. For example, changing a 15-year old appliance to a more efficient model can save up to 60-70 euros in electricity bill but may take many years to pay back the investment. In addition, the saving is much less, around 17 euros, when the replaced appliance is only 12 years old (Välimäki 2001). The eventual energy consumption is therefore much dependent on the daily use and location of a refrigerator-freezer. If the old appliance functions well there is no use to change it for a new one. In case the machinery whirs all the time, or frost is built up fast it is likely to be an energy spender. Also, the seals or thermostat may be broken (Hymonet 2004). The consumption of electricity can also be measured with an energy monitor and if the measurement indicates that the appliance uses too much electricity, the old device is probably better to replace with a new one.

4.2.1 Environmental Information in User Manuals of Cold Devices and Best Practices

In this product group the main environmental aspects include energy consumption, length of product life time, noise, heat transmission materials and disposal of the product. Issues related to these aspects were searched from six user manuals to serve as good examples and best practices. A list of issues to be instructed (Appendix 2) was used as a basis for the evaluation of the content.

Several EU-level standards and directives guide the energy consumption and disposal of cold appliances. The EU Council resolution on operating instructions for technical consumer goods sets some requirements also for instructions for use. These are mostly general guidelines for the content and safety issues, as well as communicating the information. However, many of the recommendations promote environmentally feasible use of the appliance and help to prolong its life time. For example, the instructions should give information about typical errors, their causes and possible solutions as well as inform about customer service contacts. It is also recommended to include detachable quick reference instructions to the user manual. (EU 1998.)

Nordic Eco-labeling for refrigerators and freezers sets some requirements for user instructions, too. These include advice for optimal energy use in the operational phase, such as guidelines for placing and installing the appliance, stating the minimum dimensions of free space around the device to ensure sufficient air circulation, and also recommendations to place the appliance in a cool location and not next to any heat source or in direct sunlight (Ecolabelling of Refrigerators and Freezers 2001, 5). In addition, user instructions should give some energy saving tips for daily use.

Correct location of the device is a major contributor to energy consumption. Especially user information for refrigerator-freezers has been lacking guidelines about placing the appliance and using it in special circumstances such as in cold climate. In addition, user information for refrigeration appliances should be clearer in terms of content, appearance and manner of representation. (Marjamaa et al. 2002, 48.)

All the six manuals examined include advice on location and a caution not to locate the appliance close to a source of heat or direct sunlight. Clear instructions, motivating pictures and attention capturing colours are used for example in Helkama Forste user manual¹⁰ to inform the user about correct placing of the appliance. Furthermore, five of the six manuals include numeric information about the minimum dimensions of free space around the appliance including the top, height, width and depth space, and inform about the lowest and highest location temperature, as well as caution not to locate the appliance in damp or dusty space, such as unoccupied attic. This is an essential caution especially in countries with cold climate, and where people use refrigerator-freezers also in part time housing, such as in summer cottages, and leave them switched off for the winter period. But in addition to the lay down advice, there should be instructions about taking the device back in use, e.g. stating that the device must reach room temperature before switching it on.

Half of the manuals include tips to reduce or monitor the energy consumption. In three manuals it is also encouraged to regularly control over the condensation and compressor pipes that they are on place and clean.

¹⁰ Helkama Forste JP321, JV341

Two of the manuals advise even more detailed tips such as statements that each degree of cooler temperature increases the electricity consumption by 5 %. Only two of the six manuals mention the importance of the door seal and its proper functioning although it is seen very important in the literature of cold appliances. Also, only little or no advice is given about recognizing or repairing an evident energy spender. Good examples are though Rosenlew¹¹ and Electrolux¹² manuals that provide the user with a clear table of possible problems in the functioning of the appliance, and present also potential reasons and comprehensive proposals for actions to repair it. The table in Rosenlew manual includes 14 possible or typical defaults, nine of which are related to energy consumption. For example, temperature and the proper functioning of the seals are paid attention to. This kind of table helps the user to control the energy consumption. Also, information about noise level of the appliance could be clearly provided, for example in the energy label and user manuals. This information is clearly lacking.

Cleaning and washing instructions for the cabinet and compressor are present in every manual, i.e. vacuum-cleaning the back of the cabinet and the compressor regularly. A good example of the efficient use of clarifying pictures is in Electrolux user manual, where the appliance is illustrated from beyond in order to advise which parts should be left free from cover. Also Whirlpool¹³ manual uses illustrative pictures to inform how the background of the cold appliance should be cleaned to avoid damages.

Essential tips for daily use and maintenance are clearly given in a list in Electrolux manual. This list includes 12 tips on regular maintenance operations such as cleaning the appliance, and daily routines such as placing and storing the food. Another list gives information about the noise that is normal during the function of the appliance. In addition, there is information about the ozone layer in relation to the heat transmission material of this specific product. Yet, there are tips for how to protect the environment, including advice such as recycling and disposal of the appliance, package and parts, and encouragement to follow the 12 energy saving tips given.

In the European Union, so called WEEE –directive¹⁴ determines the waste management and collection of end-of-life refrigeration devices. The aim is to reduce waste from electrical appliances and to promote reuse and recycling. This take-back policy will set responsibility to the manufacturer to accept free of charge the used refrigeration appliances and components for recycling. A lack of information about materials included in the product can be a barrier to efficient end-of-life manage-

¹¹ Rosenlew RJP980

¹² Electrolux ER8415B, ER8490B

¹³ Whirlpool CB60PL E-EV FAN

¹⁴ European Union directive on Waste Electrical and Electronic Equipment (WEEE)

ment of the product. Therefore, a summary of included materials could be useful for the recycler.

Nordic Swan label criteria encourages manufacturers to give information on reusability and recyclability of included materials, and furthermore, advice on how the consumer can make use of the manufacturer's take-back offer. Information about guarantee and availability of spare parts, and the disposal of device are given in the manuals, although the disposal advice varies greatly. All manuals include a simple request to dispose the appliance properly. In addition, few manuals include cautions about harmful materials in the appliance and thus not to abandon the appliance to the environment but to deliver it to the local recycling center.

Table 12. Environmental Information in Instructions for Use of Refrigerator-Freezers

ENVIRONMENTAL ASPECTS	GOOD	SUGGESTIONS FOR IMPROVEMENT
Electricity consumption	<i>Location and space;</i> - Instructions for correct positioning and free space around the appliance are well informed	<i>Inside temperature;</i> - The impact of cooler inside temperature to electricity consumption could be highlighted - Issues that warm the cabinet could be stressed, e.g. improperly functioning of the door seal <i>Regular maintenance;</i> - Users could be encouraged to monitor the electricity consumption, i.e. to give tips how to recognize an 'energy spender' - Reasons for increased electricity consumption could be summarized - Quantitative data on energy consumption could be given - The annual electricity consumption could be informed also in the manual - The amount of how much can be frost without using the freezing button could be advised
Life time	<i>Regular maintenance;</i> - Cleaning instructions for the device and its backside are given - Fault diagnosis check list is given	<i>Regular maintenance;</i> - Regular maintenance operations could be summarized (check list), e.g. check the door seal, hover the backside, check the condenser pipes etc.
Heat transmission material, CFC, HCFC or other	- Contribution of the material used in the appliance to the ozone layer is explained	- Information on the effects of heat transmission materials to the environment if the appliance is used improperly or damaged
Noise		- Sources of normal noise, as well as sources and possible reasons for extra noise could be summarized - Level of normal noise could be given
End use	<i>Disposal;</i> - Users are encouraged to deliver the end-of-use appliance to the correct collection point	<i>Part-time use;</i> - More detailed instructions for lay down, storage and taking the device back in use <i>Disposal;</i> - Information on the effects to the environment if the appliance is used or disposed improperly - Information on the materials in the appliance and their recyclability (and / or how the user could utilize the producer's take back offer)
Other	- Clarifying figures and tables are presented	- Environmental issues could be summarized in a special chapter

4.2.2 Comments from the Feedback Group of Cold Appliances

In the feedback group, there was seen a difference between typical use and correct use of an appliance. It is typical, that consumers do not even read the instructions before starting to use the appliance, which may cause some damage to the appliance or unnecessary energy consumption. By

By examining the user manual, many contacts to service and repair stations could be avoided. The feedback group agreed that some kind of simple detachable user manual with quick tips could be delivered to the consumer in addition to the traditional user manual. This 'quick-manual' could include the basic user and safety instructions as well as indicate how the consumer is able to achieve energy savings and extend the life time of the appliance. In addition to the energy label, the energy consumption per year and level of noise could also be informed in the user manual and detachable instructions.

Manufacturers have their role in delivering consumer information and such product as cold appliance offers many possibilities for eco-design, such as to place guiding and reminding properties to the product. For example, the manufacturer could place symbols and stickers to guide and remind consumers of correct maintenance operations. In addition, the role of the seller was seen essential in delivering the user information guidance the consumers. Also, posters and other material could be placed in the shops and delivered to the buyers of appliances. Especially, the potential of Internet for user information was highlighted in the feedback group.

4.3 Environmental Aspects of Furniture

Environmental impact of actual use of furniture is limited to chemical release from wash and care operations (Figure 8). The major environmental impacts of furniture, however, are losses of materials and energy, and emissions of pollutants in production. Therefore it is important to decrease the need for furniture production by extending the product life time and by promoting recycling and reuse.

Today the average life time of furniture exceeds 10 – 12 years, but could be extended to last 25 years, or even longer (UEA 2004). Proper care helps to maintain furniture in a good shape and function, and to prolong its life time. In addition, furniture can be modernized or recycled through resale or charitable organizations, or given to family members, or it can just be placed to another room for non-daily use. Favoring recycling and reuse instead of disposal decreases the amount of waste associated with furniture.

Figure 8. Environmental aspects of furniture

4.3.1 Instructions for Use of Furniture and Best Practices

Furniture consists of a variety of materials. For example, sofas and arm-chairs include wood structures in average 57 % of weight, PU foams 15 %, cover materials 13 %, cardboards 10 %, and metal 5 % of weight. Two thirds of the upholstery materials consist of fabric, and one third of leather. (UEA 2004)

The types of materials in sofa contribute to the way in which the sofa should be taken care of while in use, and how it should be handled in reuse, recycling and disposal. Therefore information on material content is important. If consumers are aware of materials included they are able to choose the correct wash and care supplies and postpone the disposal for many years. In addition, the sofa could be reused or recycled more efficiently if the consumer knows the pieces of material included. Also, the Swan Label criteria for furniture expect that instructions for use include such information on materials, and advice about their recycling or environmentally sound disposal (Swan Label Criteria for Furniture 2003). To enhance recycling, it would be beneficial to also mark the recyclable components into the sofa and packing materials.

Another important issue to be advised is the correct method of cleaning and washing of different materials (Swan Label Criteria for Furniture 2003). For certain materials regular preventive treatment with a chemical fabric protector or similar is recommended. For such materials the right methods, fabric protectors and frequency of treatment should be instructed. In addition, instructions and methods for regular cleaning such as the quality of cleaning agent, are important. Instructions for use may include also guidance about regular vacuuming, dusting and removal of stains. For example, regular vacuuming helps to resist the dust to accumulate in the fabric. Removal of stains, instead, should be done immediately after spilling. Proper instructions about stain treatment should be given, especially if the use of stain remover is prohibited. Sharp items and harsh rubbing must always be avoided.

Wash and care instructions are presented as symbols in washing declaration attached to textile¹⁵. This information could also be explained by words in the instructions, or at least it should be mentioned where the washing declaration tag can be found in the upholstery. Since fabrics vary greatly in their reaction to different spills, stains and removers, it would

¹⁵ More in chapter 4.4 Environmental Aspects of Textiles.

be helpful to give material specific advice about cleaning upholstery fabrics. Hence it is unlikely to be able to give all the detailed information on the removal of different kinds of stains, there could be a link in the instructions referring to a database where typical stains and their removal from different materials are advised. This link could be a web address to the manufacturer's data or to another database. Further, the right method of cleaning could be tested on a pattern sample delivered with the sofa. Another means to test textile cleaners is to slightly drop the cleaner to a hidden part of the furniture and wash (AFFJI 2004, 19).

Care instructions are also important for the frame, including instructions for different types of materials, such as metal and wooden covered frames, e.g. natural wood, polished, oiled and waxed frames. The frame may also consist of other material, e.g. metal, when certain cleaners should likely to be avoided. Also other useful cautions, although they might sound simple, could be mentioned in instructions. For example, wooden sofas should be placed in constant humidity, since differences in humidity may cause wood to swell or shrink. In addition, exposure to high temperatures can damage furniture as the wood may crack, or the upholstery may flatten due to hot items. Especially damaging could be placing the sofa in direct sunlight. Colored upholsters are likely to fade in sunlight, and they should be protected for example by dressing them with fabric throws. Other advisable things are discouraging children jumping on the coach and pets using furniture for their activities. (AFFJI 2004, 3, 8-11.)

In addition, some tips to keep the sofa beautiful and comfortable might be worth advising. This may include tips such as regularly rotating both sides of the reversible cushions, plumping up the pudding, placing coverings to the bottom of legs, and when moving the sofa, always lifting it by the base of the frame. Also, it could be instructed on how to repair minor damages.

In this product group the most important information need is the material content of the product so that the user is able to repair and care the furniture as well as to take it to the proper recycling. A good example of the material content is in IKEA sofa instructions. They are available in the IKEA database for all the models, and the seller can print them to the buyer. This paper includes the material content for all parts of the furniture, e.g. for the bodywork, textile, wooden surfaces and other materials. There are also wash and care instructions for most of the furniture models. What could be added, however, is the information or tips for repairing and modernizing the furniture.

Another example of instructions for use is a leaflet accompanying the sofa model Insofa, Indoor Group. This leaflet provides the basic wash and care instructions and lists activities that are not recommended. These instructions focus on sustaining the sofa in a good condition and prolonging its life time. In addition, consumers are motivated and activated with

clear pictures. Also a separate piece of upholstery fabric that can be used as a test before washing the material is attached. In addition, Asko Indoor Group has comprehensive furniture care instructions in their web pages.

One idea, which was not yet found from the furniture, would be to place a paper formula of the upholstery and dimensions of the wadding to a pocket or to the bottom of the sofa, so that the user could recover the sofa when the old upholstery fades, or could modernize the appearance of the sofa with new fabric instead of buying a new furniture.

Table 13. Environmental information in instructions for use of sofas

ENVIRONMENTAL INFORMATION IN INSTRUCTIONS FOR USE OF SOFA	
LONGER LIFE TIME	
Care instructions for upholstery and frame	<ul style="list-style-type: none"> washing declaration symbols explained by words possible additional texts to washing declaration and instructions about drying (spin / tumble / indoor / outdoor drying), stretching etc. washing instructions for the frame (damp, wet or dry wiping, etc.) instructions about regular maintenance cleaning, such as wiping, airing, vacuum-cleaning, removal of stains, brushing instructions (including frequency) for possible care treatments, such as waxing information and recommendations about cleaning agents, and cautions of cleaning agents not to be used cautions of items not to be used (such as sharp items, brush) link to the additional information for textile and frame care (such as the www-address of the manufacturer, or other database) textile sample delivered with the sofa for cleaning or coloring test
Durability in use	<ul style="list-style-type: none"> notice about durability of 'normal use' additional notices about actions not to be done, such as jumping on the sofa etc. etc. advice to place coverings on the bottom of legs between the floor and the sofa (coverings accompanying the instructions) notice where the sofa should not be placed and why e.g. keep the sofa away from direct sunlight or plant lamps, humidity and heat, since they may cause fading other instructions, if needed, such as advice about lifting the sofa, etc. actions against wearing and tearing, e.g. regularly use both sides of cushions to make them last longer
CHEMICALS FROM WASH AND CARE	
Detergents	advice to follow the instructions in cleaning agents
END USE	
Reuse, recycling and disposal	<ul style="list-style-type: none"> data about materials included e.g. material for frame, padding, upholstery, etc. instructions for recycling of materials markings of recyclable items in the sofa markings for correct disposal of the packing material tips for reuse and modernizing formula of the upholstery

4.3.2 Comments from the Feedback Group of Furniture

Instructing the use of furniture was seen important in the feedback group. However, there was an opinion, that at the moment instructions for most furniture are generally somewhat insufficient, and the availability of instructions is much depended on the activity of the customer in asking for the instructions, or the seller in delivering the information in the purchase situation. Overall, the instructions should be delivered to customers more often and more easily, for example as a leaflet following the sofa, or as a

paper printed out by the seller from the information database when selling the sofa.

In the feedback group, information about material content was highlighted due to its importance in daily wash and care, repair and recycling operations. Since recycling regulations vary greatly between countries, it may be difficult to give common detailed recycling instructions, especially for globally traded furniture. Even country specific recycling advice may turn out to be complicated since the recycling systems differ also within a country. Therefore it is also the consumer's responsibility to check the local recycling regulations and to follow them in accordance with information about the material content. Similarly, the consumer is able to select materials and supplies for protective treatments, coloring, repairing and modernizing the sofa when the materials are known. In addition, it was seen important that instructions for use should include advice about repair and small fixings of furniture.

Instructions for the use of sofa are mainly considered to be the manufacturer's duty but could be advised otherwise as well, since the manufacturer or the seller are not the only channels to provide the information. Also newspapers, magazines, media and public organizations may serve as generators of environmental information. These parties could encourage consumers to take actions to longer the life time of furniture. Garden furniture is an example of items that can be instructed seasonally during their use period from spring to autumn. For example newspapers or magazines could publish articles about correct summer and winter care of outdoor furniture. Similarly, during holiday seasons, professional washing and caring operations could be instructed, or from time to time consumers could be reminded about correct maintenance, cleaning and fixing. In addition, tips for repairing, modernizing, reusing, recycling and decorating could be given as more general instructions such as in the home decoration departments in the shopping centers or in newspapers and magazines.

4.4 Environmental Aspects of Textiles

Wash and care practices represent the most important environmental aspect of textiles. It is estimated that wash and care account for two thirds of the total environmental load during the textile's entire life cycle (Talvenmaa 2002, 57, 84; Suojanen 1997, 51). The environmental burden occurred in the use phase is mainly related to water and energy consumption and chemical surplus. Even though people favor textiles that are produced in an environmentally sound way, these benefits become usefulness if the textile is not taking care of appropriately.

Approximately 10 - 20 % of household water is used for laundry (OECD 2001) and laundry washing machines account for around 6 % of

the residential energy consumption (Adato Energia 2003) most of which is needed for water heating. For instance, switching the water setting from hot to warm or cold, can reduce energy need 30 – 50 % (Wash-Right 2004). Energy is consumed also for drying, ironing and pressing. In case of dry cleaning, the process is very energy-intensive.

Extending the life time of clothes is another important means to decrease the environmental impacts of textiles. Regular and correct care is essential. In addition, ability to modify or repair clothes is important. This requires consumers to gain knowledge of different features of the textile, as well as facilities to make the fixings.

Figure 9. Environmental aspects and impacts of textiles

4.4.1 Instructions for Use of Textiles

A common cycle in the use phase of clothes (Figure 10) includes activities from storing and daily use to washing and after-treatment. During the use phase, textiles have to be washed and cared probably hundreds of times before their end life. Also, after the end life they likely re-enter the cycle as modernized or as second hand recycled textiles. Clothes may also move to the end life directly after any of the phases in the cycle. To prolong the useful life time of textiles, special instructions in each phase of the cycle are essential.

Storage

Clothes should always be stored clean and dry. It is essential to avoid unnecessary washing but if textiles are stored dirty for a long time, they may lose the good quality. Especially, silk may damage if stored dirty. If the textile (especially woolen sweater) is not in use for a long time, it should be stored in a closed plastic bag in order to avoid clothes moths (Ruskovilla 2001).

Use

It is important that after use clothes are hung up or fold, and regularly aired and possibly brushed. Especially for woolen sweater, airing extends the washing frequency for weeks. Thus woolen garments do not need such frequent washing as cotton clothing. They do not become dirty as easily as some other materials; in fact they are capable of cleaning themselves with oxygen (Ruskovilla 2001).

Usually it is better to use removal of stains instead of washing the entire textile if there is only a spot in the garment. However, there are exceptions, such as silk and some artificial textiles that may damage if stain remover is used (Ruskovilla 2001). Chemical detergents in stain removals may be harmful to some materials and their suitability must therefore be checked before using.

Wash

Before loading the washing machine, clothes should be sorted according to color (dark, white and red colors separately), material, temperature and dirtiness. However, full loads should be washed since many washing machines use the same amount of electricity and water whatever the load is (Wash-Right 2004). The washing machine is correctly loaded when there is enough room to place a fist between laundry and the top cover and the laundry will not crinkle too much (Aalto 2004)¹⁶. If it is necessary to run a small load, the water setting should be adjusted appropriately by using energy save program or half load button.

The purpose of the washing declaration is to give adequate wash and care information. The standard of textiles and care labeling code using symbols (ISO 3758) requires instructions on water/hand washing, bleaching, ironing, chemical washing and drum drying. Usually this information is given in symbols, but may as well be stated by words (ISO 3758). In addition, there should be an additional text in washing declaration, in case some specific information is essential. For instance, if the garment shrinks or stretches over 2 % when washed, or if the garment must be washed with similar colors or inside out, or if there is a piece of material in the garment that damages in water wash. Also, it should be mentioned if spin-drying is prohibited or respectively recommended, or if softener is not allowed to use. (TSL 23 901.)

¹⁶ Verbal notification in the feedback group discussion 28.1.2004 SYKE, Helsinki.

Consumers must also follow the instructions in the package of the cleaning agent. Overdosing may cause precipitates in the washing machine or clothes, which will lessen the washing result and even damage the washing machine (Wash-right 2004). This is also the case with softeners. If too much softener is used it may accumulate to textiles and cause quality problems, as well as increase the chemical concentration in waste water. To lessen the environmental burden, eco-labeled care products are preferable.

If there is a dirty spot on the garment it could be removed carefully with water or liquid detergent, but soaking or pre-washing the garment is not recommended. Before washing it is also important to close zips and buttons, and empty pockets. For many materials, even if not separately mentioned, it is beneficial to wash them inside out in order to avoid unnecessary injuries on the surface. If the garment is hand washed, it is extremely important to soak the cleaning agent well into water in order to avoid color damages. It is recommended to wash woolen and silk garments by hand, using silk or wool washing detergent, or detergents with pH rate 7 to 8 and which do not include enzymes or bleaches. The garment should be squeezed lightly avoiding rubbing, after which rinsed 2 to 3 times, and water should be squeezed carefully out of the garment avoiding wringing. (Ruskovilla 2001.)

In order to minimize the consumption of energy, the lowest possible water temperature is advisable. If the temperature is 60 °C instead of 90 °C, or 40 °C instead of 60 °C, 30 % of energy is saved (Pyykinpesun tietopaketti 2003). If the laundry is only slightly soiled it should be washed in the washing machine at 30 to 40 °C temperature unless otherwise instructed. If the garment is not allowed to be washed in lower temperature than instructed, this must be clearly stated by words in the washing declaration (TSL-23-901). Only, if the garment is heavily soiled the lowest possible temperature may not be sufficient, since the save in energy with lower temperature may easily be wasted if the garment will not clean expectedly (Talvenmaa 2002, 60).

After-wash

After washing the garment it should be stretched into its appropriate form and let dry on a clothesline. Instead of using energy-intensive dryers, such as tumble dryer or drying cabinet, it is recommended to dry clothes in indoor or outdoor air. This causes no electricity consumption and also makes clothes last longer. Garments should never be spread to dry in direct sunlight or close to a source of heat. Iron, if needed, is usually recommended from the reverse side. Actions that reduce the need for iron include stretching the garment into its measurements after wash, filling the washing machine correctly, airing, and storing the laundry smoothly. After washing it is important to turn off the water tap and electricity from the washing machine.

End Use

With appropriate care it is possible to prolong the garment's life time. These actions include fixing small gaps in the garment immediately, or covering them with a piece of fabric, enlarging or cutting the size with extra fabric, or changing and modernizing the appearance. Life time can be prolonged also by reusing or recycling clothes. Instead of abandoning the garment as waste, it is better to sell it in jumble sales, second hand shops or donate to the charity organizations. Public charity organizations, such as UFF, collect and recycle millions of kilos of clothes per year, which would otherwise end up to an unnecessary waste. For example, in Finland, during the year 2002, UFF collected over 4 280 000 kilos of clothes, third of which was donated to Africa and India, and only 10 % ended up as disposal. (UFF 2004.) In case the garment is not in a correct shape, it can be reused for another purpose, such as raw material for carpets or filling for furniture, or at least as cleaning equipment.

Recycling

Figure 10. Instructions in different use phases of textiles

4.4.2 Comments from the Feedback Group of Textiles and Best Practices

Instructions for use of textiles may be given in the product itself (washing declaration), or related to the product (additional document), or as general

instructions provided by the manufacturer, seller, media, authorities and different educational institutions (Table 14). The washing declaration in the tag indicating manufacturer's instructions about water washing, bleaching ironing, chemical washing and tumble drying, is the minimum requirement for care instructions (ISO 3758), and must be stated in symbols or words. Additional words could be added to clarify specific care procedures. The tag, including the washing declaration should be sewed in the textile to a place that it is easily found and does not complicate wearing the garment. For example, for sweaters and shirts, the recommended place is the left side seam, or optionally up to the backside. (Tevasta 2002.) Usually there is not much space in the textile itself, and thus the tag in clothes should not be too large, or otherwise it would likely to be cut off by the consumer. Therefore the washing declaration contains only the most valuable instructions, although additional instructions could be given.

Detailed, product specific information could include advice about recommended cleaning agents, drying, ironing, removal of stains, brushing or airing etc. It is obvious that these additional instructions help to extend the life time of the garment and keep it in a good condition. The fact that the temperature shown is the highest allowed temperature and lower temperature could also be used (if not otherwise stated on the declaration), could be given in the additional information, also pointing out that this would save energy.

This additional wash and care information could be placed as a hanging note in the garment or in a package if the textile has one. In addition, the information could be delivered to consumers as a separate document. This manner is used for example with the products of Anne Linnonmaa. When consumers buy a garment they get an additional paper including detailed information on wash and care of the garment. This additional paper includes around 8-10 useful and textile specific instructions and also justifies why the specific advice is important. For example, what kind of detergent should be used, should the softener be used, how the garment should be dried and shaped after the wash, and what might happen if the instructions were not followed. These instructions are also available in the Internet on the manufacturer's web-pages¹⁷.

Another good example is the manufacturer Ruskovilla, that places instructions in the package of the textile. In addition, Ruskovilla has an extensive material of care instructions available in their Internet pages¹⁸.

The most general instructions about wash and care, such as washing frequency or sorting of textiles as well as repairing clothes, are rarely given in the textile itself, and thus must be instructed otherwise. Previous studies¹⁹ indicate that textile wash and care operations in European

¹⁷ www.annelinnonmaa.fi

¹⁸ www.ruskovilla.fi

¹⁹ See e.g. Aalto, K. 1998; 2002.

households have become more environmentally sound, even though some improvements still need to be adopted. The current effort should focus on washing fuller loads but less frequently. In addition, households should pay attention to the hardness of water according to which the amount of laundry detergent is used. (Aalto 2002, 57-60.) It seems that there is also a need for promoting the skills to repair and modernize textiles. In 1999, only 0,3 % of household expenditure in the EU-area was spent on materials to make, repair or hire of clothing, whereas average 6 % of expenditure was spent on purchase of clothes²⁰ (Consumers in Europe 2001, 88).

The current emphasis on sustainable consumption sets certain pressures to schools and other educational institutes to take an active role in teaching the benefits of environmentally sound procedures, such as wash, care and repair operations, and engaging households to adopt these tasks as their daily routines. General wash and care instructions can also be given in the stores and markets continuously. This would, however, require the consumer to take effort to gather the pieces of information. It would also be difficult to determine who should be responsible for arranging such information. The clothing industry and media could act as contributors towards environmentally sound textile procedures by promoting issues of "green" textile care. For example, magazines could arrange regular information campaigns or publish articles and news sheets about environmentally sound textile care practices and inspire consumers to repair, modernize and hire clothes instead of buying new ones. Clothing industry and consumer organizations could promote a trend towards favoring second hand clothes and could develop long lasting and re-fashionable garments.

Manufacturer, importer and seller play an important role in delivering the product specific care instructions. The manufacturer is required to issue the washing declaration and to give the correct product information for additional instructions, but the importer and seller are partly responsible for delivering this information to consumers. Consumers, on the other hand, are expected to be aware of the symbols of care instructions and basics of washing such as choosing the correct temperature and methods of washing and ironing. This is important not only in the use phase but also when buying clothes, since much of the environmental burden of textiles is already effected in the purchase situation depending on how easy care, good quality and long lasting garments the consumers choose.

²⁰ However, no data was found indicating the share of second hand sales.

Table 14. Summary of instructing textile use

Washing declaration	Other product specific instructions	General wash and care instructions
How to be instructed?	<ul style="list-style-type: none"> In tag: <ul style="list-style-type: none"> - 5 symbols, or words - additional texts 	<ul style="list-style-type: none"> hanging note in the garment additional document package verbally 	<ul style="list-style-type: none"> information campaigns articles, news teaching consumer service
What to be instructed?	<ul style="list-style-type: none"> washing method and temperature bleaching drying and ironing 	<ul style="list-style-type: none"> Detailed information on: <ul style="list-style-type: none"> drying methods bleaching airing cleaning agents storing 	<ul style="list-style-type: none"> sorting clothes dosing detergent machine load specific features of different textile materials
Who could be responsible for delivering instructions?	<ul style="list-style-type: none"> manufacturer responsible for reliable and adequate information 	<ul style="list-style-type: none"> manufacturer; to gather the information importer and seller; to deliver the data to customers 	<ul style="list-style-type: none"> schools media, magazines clothing factory manufacturers, importers and sellers
What could be consumer's responsibility?	<ul style="list-style-type: none"> to learn washing symbols and basics of washing correct dosing to follow the instructions 	<ul style="list-style-type: none"> to adapt and follow the instructions to ask for special instructions 	<ul style="list-style-type: none"> to find and gather the information (e.g. from the Internet)

4.5 Environmental Aspects of Cleaning Chemicals

The product group of cleaning chemicals ranges from all purpose cleaners to laundry detergents and special cleaners such as chlorine bleach chemicals and stain removers. In this study cleaning chemicals are represented by laundry detergents and all purpose cleaners. The major ingredients in such cleaners are surfactants (tensides), water-softeners (zeolite, phosphate) enzymes, fragrances, solvents and scouring abrasives. Also chlorine is used in some cleaners as a bleaching agent. Surfactants lower the surface tension of water allowing the cleaning agent to penetrate the textile and remove the dirt. Enzymes or silicates are not harmful to the environment whereas bleaching agents and phosphate cause environmental burden in the areas with no waste water treatment systems. Because cleaning products are generally rinsed or discarded down the drains, the use of less toxic ingredients reduces the environmental impact. When developing environmentally sound laundry detergents, phosphate is mainly replaced by zeolite since phosphate serves as an accelerator of eutrophication (Talvenmaa 2002, 59, 60). Also, if surfactants are not readily biodegradable they may persist and harm ecosystems (Välimäki 2001).

Environmentally friendly labeled cleaning products are considered biodegradable and contain limited amount of harmful ingredients such as phosphate (Ecolabelling of Laundry detergents 2001). However, even

though a consumer selects an eco-labeled cleaner, the environmental benefits are partly lost if it is overdosed. This leads to increase in waste water and chemicals, solid waste from packages and over consumption of natural resources.

Figure 11. Environmental impacts, aspects and issues to be instructed of detergents and all purpose cleaners

4.5.1 Information in Instructions for Use of Cleaning Chemicals and Best Practices

Several directives of the European Union guide the content of cleaning products and their packaging. Also the criteria for eco-labels set requirements for the user information given in the eco-labeled product, which can be applied as a good practice to instructions for use of cleaning products in general.

Product packages and attached information were studied to get a picture of the current state of environmental information. Altogether 15 packages of all purpose cleaners and 25 packages of laundry detergents consisting of concentrated, non-concentrated and liquid detergents were screened and compared to the detailed list of environmental information (Appendix 5).

Dosage information

To avoid excessive amounts of waste water, the correct dosage is essential. Dosage instructions of laundry detergents should appear in the package stating the correct dosage in milliliters for normally and heavily soiled fabrics for three water hardness classes i.e. soft, medium and hard water (EU 2003) and for at least two of the most common machine sizes (Ecolabelling of Laundry detergents 2001, 11). When needed, the text stating that 'difficult stains need special treatment before washing' must be clearly advised (EU 2003).

The country specific water hardness should be highlighted in the package, or at least, the dosage recommendations should appear in the package together with a recommendation for the consumer to contact his water supplier or local authority in order to find out the degree of hardness of the tap water in the area (EU 2003). With a 3-4 kilos sized washing machine, the dosing is 60 - 100 % more for hard water than for soft water²¹.

All the packages of laundry detergents include the dosage information in general, and in 20 of the 25 packages the information is given for at least two of the most common machine sizes and for three categories of water hardness. In addition, 8 of these packages inform about the common level of water hardness in the area, or at least encourage consumers to contact local water supply authorities to find out this information. Furthermore, the dosage information according to dirtiness of laundry is given in 20 packages, 14 of which include dosing for normal, medium and heavily soiled laundry by tables, pictures and milliliters, and 6 packages inform by words that if the laundry was heavily soiled, the dosing might be forth to add on.

Good dosing instructions exist in many of the laundry detergent packages. For example in Bio Luvil and Minirisk packages, dosage information is given according to the hardness of water, dirtiness of laundry and size of the washing machine. These instructions (Examples 4.1 and 4.2) highlight the softness of water in the country where 80 % of the tap water is soft. The table is clear enough to quickly adopt the correct dosing for the average household laundry but gives information also for larger size of washing machine and for different dirtiness of textiles if needed.

²¹ Calculated from 'Pirkka Green' and 'Minirisk Color' packages.

Example 4.1 Bio Luvil 1,35 kg concentrated powder, Lever Fabergé

Dosing for 3 -5 kg washing machine			
Only slightly soiled –less 50 %			
Heavily soiled laundry – add 20 ml	Water hardness	Soft	Medium
Larger washing machine – add 50 %	Normally soiled	42 ml	60 ml
			75 ml

Example 4.2 Minirisk Color 850 g, Henkel Norden Ltd

Size of the machine	3–4 kg	5–6 kg
0 – 6 ° dH Soft COMMON	55 ml	110 ml
7 – 13 ° dH Medium	80 ml	160 ml
14 –21 ° dH Hard	115 ml	230 ml
Hand wash	10 l water	30 ml

If the laundry is heavily soiled the dosing may be needed to add on.

Yet, another good example of stating the regional water hardness is in Ariel Sensitive (750 g concentrated powder), which illustrates the water classes within a country by a map where the areas being of different water hardness are illustrated with colors.

Best practices include also informing by the shop about the hardness of the water in the municipality. The hardness of tap water as well as the typical hardness of spring water could be given on the edge of the product shelf.

Generally, consumers should not use a dosage cup larger than 50 milliliters to avoid using too much detergent (Pyykinpesun tietopaketti 2003). This is a relevant advice especially in northern Europe where water quality is soft in most parts. Overdosing burdens the environment and, instead of cleaning, the detergent may accumulate in the fabric and reduce the quality of textile and shorten its life time (SLL -Pesuaineet 2004). In order to encourage consumers to avoid overdosing, a dosage cup (50 ml) showing a scale of at least 10 milliliters steps should be available if it is not included in the package (EU 2003).

For all purpose cleaners dosage information is informed in 11 of the 15 packages including illustrations such as figures or pictograms and information on the most effective means of using the product. In 10 of the all purpose cleaner packages it is also stated that if the surface was heavily soiled, the dose should be added on, but the exact amount of how much, is not stated.

In all purpose cleaners, dosing instructions are not given for different water hardness classes. A good example exists, however, in the package of Ajax All purpose cleaner (750 ml) where the dosing information is given according to the water hardness.

Dosing could be clarified by a pictogram, indicating for example the number of caps with milliliters for a tub (EU 2001). For the sufficient dosage, it is recommended to state the most efficient way of using the cleaner, such as spotting the cleaner directly to a stain, or using the dosing ball instead of measuring in the washing machine etc. In most of the all purpose cleaners dosage instructions are, however, given only for 'general cleaning' with one concentration and not sorting the different manners of cleaning. One good example is, however, the Daily All purpose cleaner (Example 4.3) that pays attention also to the material to be cleaned and to the way of cleaning, i.e. gives different dosage to slight and thorough cleaning as well as for glass and mirror surfaces.

Example 4.3 Daily All purpose Cleaner 750 ml, Inex Partners Ltd

Dosing:

Slight cleaning 17 ml / 5 l water

Thorough cleaning 30 ml / 5 l water

For glass and mirror 4 ml / 5 l water

Best practices include also good dosing system for the cleaner. A pump giving 1 ml or smaller amount of liquid could be sold close to every purpose cleaners and other liquid cleaners.

Suitability of cleaner

Suitability of detergent is one of the most important concerns since the garment or surface may fade, shrink or severely damage if wrong quality cleaning agent is used. The suitability of the product should be mentioned in the package, especially if the product is not suitable for a certain fabric or surface, for example, for silk textiles or wooden surfaces. Use of unsuitable detergent or cleaner may shorten the target's life time and lead to premature waste creation and consumption of resources, which are considered as indirect environmental impacts of cleaning chemicals.

All purpose cleaning products receive high points in stating the suitability of the cleaner for specific surfaces. In most of the packages the suitability is informed by words, for example stating that the cleaner is suitable for all washable or water resistant surfaces, or by clear symbols of the applicable surfaces. Few of the packages include both the text and the symbols.

In laundry detergents, non-suitability is informed in 17 of the 25 packages by mentioning the materials which the detergent is not suitable for. Also half of the laundry detergents that are not labeled as 'color' deter-

gents include caution about colors fading in continuous use of this detergent, and state that for colored laundry, it is preferable to use the ‘color’ labeled version of the product. One good example is Omo Sparkling (Example 4.4) that gives clear and meaningful statements about suitability of the powder. In addition, action verbs are used to encourage consumers to follow the instructions and textile washing declaration. Tips for best washing result are clearly shown and highlighted with blue color to capture the consumers' interest.

Example 4.4 Omo Sparkling 1,35 kg, Lever Fabergé

- Do no use for wool or silk
- All detergents with bleaches may fade colors of textiles
- For continuous use for colored textiles we recommend ‘OMO Color’ labeled detergent
- For hand wash we recommend liquid OMO detergents

Way of washing

Instructions on how to achieve best washing results are given in half of the laundry detergent packages by encouraging consumers to use for example a dosing ball. The caution about not to pre wash or not to soak the textile before washing is included only in 7 of the 25 packages even though it is generally recommended not to pre wash or soak textiles. Statements on sorting the laundry according to color, dirtiness and material are given in 11 of the 25 detergents. 13 of the packages encourage consumers to follow the textile's washing declaration. Caution not to under fill the washing machine is given in 20 detergents, 18 of which in terms of Wash-Right symbols, and in two packages by words.

A good example is OMO Sparkling (Example 4.5) where action verbs are used to encourage consumers to follow the instructions and textile washing declaration. Tips for best washing result are clearly shown and highlighted with blue color to capture the consumers' interest.

Example 4.5 OMO Sparkling 1,35 kg, Lever Fabergé

TIPS FOR BEST WASHING RESULT:

- Always follow the dosing instructions and washing instructions in textiles
- Always use a dosing ball
- Place the dosing ball open side up on top of the laundry etc...

Another good example is Pirkka Green (Example 4.6) that gives clear and meaningful statements on how to get the best washing result.

Example 4.6 Pirkka Green 1 kg concentrated, Ruokakesko Ltd

Pre wash is not needed and soaking is not recommended.
When used in hand wash of laundry, always dissolve the detergent completely in the water.
Soaking the textile or incompletely dissolving of the detergent may damage colored fabrics.

As much as 13 of the 15 all purpose cleaner packages advise on how to gain the best washing result. However, only one of the all purpose cleaners advises consumers to use the cleaner also as a 'quick cleaner' with lower concentration and smaller amount of cleaner, whereas generally the dosage instructions were given only for producing large portions of liquid, usually for 5 liters, which may be difficult to proportion to smaller quantities quickly. None of the packages encourage consumers to produce the cleaning liquid no more than needed.

Place of washing

Place of washing is essential in order to minimize the chemical flow to the environment. For example, in areas with common waste water systems, phosphate is not as harmful as in the areas with no waste water systems (Kuluttaja ja Kemikaalit 2001, 6). Thus, especially detergents including phosphate should state caution not to spill the detergent directly to the water system. For example, Serto (1,5 kg) states that 'Detergent containing phosphate should not be dumped directly to the environment'.

Refilling and disposal of package

Areas for improvements exist in advising consumers on the correct refilling or disposal of the package. The notice to use refillable packages is found only in one of the all purpose cleaner packages with clear instructions to refill the package, and with a statement that the package can easily be refilled with given instructions. In addition, only one fifth of the all purpose cleaners and laundry detergents contain clear statements on how to dispose of the package. However, the international symbol of recycling

or the 'Grüne Punkt' symbol is found in few of the packages, but as such these markings do not give the clear and simple information on how to dispose of or recycle the package. For the consumers benefit it should be clearly stated where the product can be recycled, for example, if the package is suitable for composting.

Packages made of carton can often be used as a collection bin for composting organic waste. In case the package is suitable for composting, this could be informed also in the packages. Even more important, if there is plastic inside the carton (e.g. in case of some dish washing powder) and therefore is not suitable for composting, this should be stated 'non-compostable' in the package. Few good examples of disposal information are written below.

Example 4.7 Daily All purpose Cleaner 750 ml, Inex Partners Ltd

The package is plastic and can be recycled or delivered to the collection of combustible waste.

Example 4.8 Daily Sensitive concentrated 850 g, Inex Partners Ltd

Environmental information: ...Packaging is made of carton, which can be recycled or incinerated.

Other instructions towards environmentally sound washing and cleaning

Some of the literature of environmentally sound washing underlines the advice on how to wash ecologically to be added in the package. For example, it is recommended to add a statement in the product, which informs that 'proper dosage saves costs and minimizes environmental impacts'. In addition, issues such as pre-sorting laundry, washing full loads, not using too much detergent and choosing low temperature, should be stated in the package (EU 2003).

Obviously the larger the package the more space for detailed instructions. In Bio Luvil (1,98 kg) package, the space allows much detailed information. In this package good tips for washing are given to get the best washing results energy efficiently.

Example 4.9 Bio Luvil 1,98 kg, Lever Fabergé

BIO LUVIL TIPS FOR WASHING

1. **Sort the laundry before washing** according to the color, material, dirtiness and washing declaration symbols. Always wash white and colored textiles separately. Wash the dark colors always separately for the first time.
2. **Follow the washing instructions**; always wash textiles according to the given instructions.
3. **Doze accordingly**. Over or under dosing degrades the washing result. Always use a dosing cup and follow the dosing instructions.
4. **Fill the washing machine correctly**. Wash full loads, avoid under filling. If you wash incomplete loads, use the energy saving program. Over loading may damage the machine and worsen the washing result.
5. **Prepare the hard stains in the laundry** according to the following tips...

It is possible to encourage consumers towards environmentally friendly washing by stating it in a clear and meaningful way, as for example in Pirkka Green All purpose cleaner package (Example 4.10). This simple statement does not necessarily even require much space.

Example 4.10 Pirkka Green 1 l, All purpose Cleaner

‘Less amount of cleaner – less environmental impacts.’

It is also important to advise the contact information of the company or retailer where the consumer could ask for more information on the product and the environmentally friendly way of washing. One example is the Wash-Right –program, where tips for ecological washing are indicated by words or symbols and more information is available behind a website link. The Wash-Right symbols remind consumers of measuring the detergent according to soil and water hardness, using the lowest possible temperature, avoiding under filling of the washing machine, and reducing package waste (Wash-Right 2004).

The contact address or customer service phone number is found in 13 of the 15 all purpose cleaners and in 23 of the 25 laundry detergents. However, only in one of the all purpose cleaners the consumer is encouraged to contact the service line or web address to achieve more information on environmental issues.

In laundry detergents, advice about ecological way of washing is mainly given in the form of Wash-Right symbols and statements. 18 of the 25 packages include the four Wash-Right symbols and in addition, 7 of these packages explain also the symbols by words. In addition, four of the detergents encourage by words the consumer to find out more about

environmentally friendly washing. A good example of the environmental information in the manufacturer's web pages is found on www.omo.com -pages behind a link 'Environment'. This page provides the reader with thorough information on the product as well as on the environmental sound washing.

A recent survey of the detergent and cleaner packages identified some aspects in the packages that may be confusing to the consumer. Although the information in most of the packages is understandable and easily readable, the small font and several languages in packages may cause misunderstandings. In our study, in 5 of the 25 laundry detergents the instructions are given in several languages, even in nine different languages, which make it confusing to find the information quickly and easily. In many cases the amount of information seems to be limited due to the size of package, and therefore some of the essential information, such as the most common water hardness, or cautions not to soak or pre wash, are not clearly recognizable as printed with a very small font. Therefore, the use of colors and eye-catching symbols are useful. However, symbols as such, without explanations, do not necessarily lead to expected washing practices.

Overall, the instructions for use are written correctly, with no language mistakes and with active voice to encourage consumers to act as stated. Also colors, tables and symbols are used in an illustrative way. The 'instructions for use' or 'dosing instructions' are highlighted in many of the packages to capture the consumers' interest.

The consumption of resources and creation of waste water could be reduced if the overall consumption of detergents and all purpose cleaners could be decreased. This can be done if the dosage instructions are clear enough and followed by consumers. More attention should be paid to water hardness and the dosing amount of detergent, since only few consumers know the exact hardness of local water (Aalto 2002, 80). Table 15 exhibits the current state of environmental information for the use of cleaners and detergents.

Table 15. Current state of environmental user information of cleaning products

	CURRENT STATE (GOOD POINTS)	CURRENT STATE (AREAS FOR IMPROVEMENT)
ALL PURPOSE CLEANER	<ul style="list-style-type: none"> - Dosage information is advised - Suitability of product is clearly stated and tips for the best washing result are given - Contact information of the manufacturer is given 	<ul style="list-style-type: none"> - Hardness of water is not noticed in dosage instructions - Dosing is informed mainly for large proportions of liquid, not for a 'quick wash' - Notice to follow dosing instructions appears only in 27 % of packages, and cautions not to over dose in 7 % of the packages - Refilling of packages is not available, or not instructed in most of the products - Disposal of package is not clearly instructed (by words) in 80 % of the cleaner packages - Consumers are not encouraged to contact the consumer service line for further (environmental) information
LAUNDRY DETERGENT	<ul style="list-style-type: none"> - Dosage information in general is given - Non-suitability is informed in 68 % of detergents - Cautions about colors fading if the product is used continuously, and recommendations to use the 'color' label of the product for colored fabrics are presented in most of the packages that include bleaches - Consumers are advised to use a dosing ball - Half of the detergents encourage consumers to follow the instructions in textile washing declaration - Contact information is given - Wash- Right logo is printed in 72 % of the detergents 	<ul style="list-style-type: none"> - 20 % of packages do not advice dosing appropriately for hardness of water, dirtiness of laundry or size of the washing machine - Only 32 % of packages advise the local hardness of water, or encourage consumers to contact the water supplier - Notice to follow the dosing instructions appears only in 36 % of packages and cautions not to overdose in 4 % of the packages - Recommendations not to pre wash or soak the laundry was given only in 28 % of the packages - The suitability of detergent, or cautions not to be used for washing close to the water front or in areas without waste water systems, are not given - Only 28 % of the detergents explain the Wash-Right symbols also by words - Disposal of package is not clearly instructed (by words) in 80 % of the cleaner packages
PACKAGES GENERALLY	<ul style="list-style-type: none"> - Instructions are easily readable despite of the small font and symbols are mostly clearly understandable - Eco-labels are easily recognizable 	<ul style="list-style-type: none"> - Several languages in instructions cause confusion - Some of the essential information is printed with a very small font - The environmental labels such as international label for recycling or recycled material, Grüne Punkt, and other eco labels do not necessarily inform consumers on how to recycle the package

4.5.2 Comments from the Feedback Group of Cleaning Chemicals

User information in packages is mostly regulated by general laws and standards, which highlight the safety issues. The most important requirement for the manufacturer is therefore to place all the needed information in the package to guarantee the safe and correct use of the product. For the manufacturer the balance should be found between informing about safety issues, marketing data and environmental advice. Since the package is very small in size, it is in many cases impossible to add all the important environmental information. In addition, in countries with more than one official language, the layout of instructions is even more difficult to execute clearly. Thus, the instructing in some parts appears to be

confusing. In terms of environmental information the correct dosing according to the hardness of water, dirtiness of laundry and size of washing machine was seen the most important issues to be instructed. In addition, environmentally preferable cleaning products could also include focus on recyclable and reduced packaging.

It was also highlighted that consumers' interest towards environmental issues plays an important role. Consumers should be active in finding the information. The feedback group considered that the manufacturer of detergent is not responsible for all the detailed washing instructions and part of it belongs to the manufacturer of the textile and washing machine as well as to consumers.

In addition, the information could be given rather in other forms than in packages. For example, in Sweden the retail trade took part in advising consumers about the local water hardness. This manner could be adapted to other countries as well. The seller could place notes close to the packages on shelves in the store stating the hardness of water in that specific area. In addition, dosage cups showing a scale of at least 10 milliliters steps should be available in stores.

Furthermore, environmental information could be delivered to consumers separately in detachable instructions added to the product, for example during a certain campaign. A good example of such campaign is small stickers that are delivered with magazines or with the product and can be pasted to the washing machine or close to it reminding and informing about correct washing manners in a simple and easily readable form²². However, in many cases the product specific campaigns may be restricted by the tight retail store concepts and thus cannot be implemented very easily. Another means to carry out such a campaign could be to establish environmental information and supplementary material in consumer magazines or similar. Also, much of the general advising about cleaning and washing as well as cleaning agents was seen to be a duty of schools and consumer related organizations.

4.6 Environmental Aspects of Paper Products

Environmental impacts of paper occur mostly in the production phase causing increased deforestation, water consumption, soil and air pollution, and contributions to biodiversity. An important environmental concern around paper use is also landfill waste and release of greenhouse gases.

²² Persil –campaign, Henkel Norden

4.6.1 Instructions for Paper Use and Best Practices

One of the main tasks of paper is to manage information by delivering, communicating and storing it. Office paper is a means of organizing information by copying, printing, faxing or writing on it. Envelopes are used as packing for pieces of information or small items, as well as a physical storage. Newspapers serve as a transferor of news, advertisements and announcements. In its many forms paper fibers eventually, maybe often after few rounds of recycling, end up to waste.

A vital link in the paper chain (Figure 12) is recycling. Reprocessing recycled paper requires only 10 - 40 % of the energy needed for producing virgin paper (Eco-Paper Production 2004) and preserves also forests, since producing one ton of virgin paper takes between 2 – 3,5 tons of trees. Overall, one fifth of all wood harvested worldwide ends up to paper. (Worldwatch Institute 1999.) Although effective recycling programs have been developed, substantial amount of paper is still thrown away as waste (OECD 2001, 219; Worldwatch Institute 1999). In 2001, the paper and board collection rate was 74 % in Finland and 66 % in Sweden, while the same rate for Western Europe was 55 % and for the USA 46 % (Paperinkeräys Ltd 2004).

Although recycling is a preferable choice compared to landfill waste, recycled fiber shortens in every circulation and becomes useless after 3-5 rounds (Paperinkeräys Ltd 2004). Therefore the most beneficial means in mitigating the effects of paper production and paper waste is to reduce the use of paper.

Figure 12. Circulation of paper

Important aspects to be instructed in paper use include recycling, reuse and reduce of paper. In general, envelopes, newspaper and printing paper are difficult to instruct since legislation and organized systems of recy-

cling and waste management differ nationally and regionally. This makes it almost impossible to place recycling instructions in the product itself, such as on envelope or paper. Except, if the envelope or paper is not recyclable for some part, there should be a marking in the product or package. Another note that could be placed into the package of paper sheets or envelopes would be a link to additional information for more information about wastepaper and recycling. Also the publishers of local newspapers could inform households about recycling by printing advice into the newspaper.

For consumable goods with recycling system the guidance could focus on two perspectives:

1. The efficient use of the product, e.g. by increasing the number of users of the product, for example more persons reading the same newspaper or magazine, or by using the same envelope several times.
2. The right sorting of products for recycling.

Advertising the first idea to consumers is not likely to gain support among envelope producers, which is quite understandable, as it could decrease the sale of the product. However, we suggest that best practices would include presenting the idea of possible re-use and shared use in these products. For example, in envelopes one could state 'good quality – possible to use several times', and on newspapers one could sometimes advertise the idea of sharing the newspaper with neighbors by stating 'share the newspaper – save money and nature'.

Regarding envelopes, best practices in the working places could include an encouragement by the administrative to re-use the best envelopes in such mailing which does not require high imago of the envelope, e.g. in internal mailing within the organization.

It is difficult to give relevant advice on sorting and recycling on products like envelopes, because there are large differences between countries and regions on the collection and recycling systems of recovered paper. Best practices on giving the sorting and recycling information evidently include a combination of different information tools, main actors being the organizers of recycling, and the waste authorities. Although campaigns, mailed leaflets and information in newspapers and magazines are important to raise knowledge, it is clear that consumers should get the information when they handle the recovered paper. Therefore it is clear that household waste containers should always include information on waste that should not be put there but instead recycled, as the waste collection point is a natural place for consumers to receive and handle this kind of information. In addition to stickers on the containers, more information could be given on leaflets on the waste room wall.

4.6.2 Comments from the Feedback Group of Paper Products

In the feedback group, it was considered that more advice could be given to households about sorting paper products for recycling but this more detailed information might lead to confusion and thus the households would likely refuse to follow them. For example, in Finland, households are instructed to throw all the paper entering the mailbox into household wastepaper. This includes, however, impurities and dirtiness that cause problems and delays in recovered wastepaper handling processes. These impurities account for around 2,1 % of the total recycled household wastepaper (Ruusu 2003). Further, envelopes account only for 1,6 % of household wastepaper but as much as 80 % of the impurities are due to envelopes. In the paper reprocess this causes such problems as coloring and worse quality, and serves as a substrate for microbes. However, the load of envelopes from households is rather small, and the problem is more due to the envelope waste generated by offices and sorted into household wastepaper. (Ruusu 2003)

The feedback group saw that handling of recovered paper should be improved in order to lessen the impurities in recycled paper, but the instructions for household should remain simple since the so called ‘everything goes that comes from the mail box’ –advise is clear and well understood in consumers’ minds. It is more efficient to improve the process than to make the instructions more detailed, complicated and time consuming by including advice about abolishing the impurities, such as glue, textile and plastics.

Overall, there is need for twofold instructions, one for households and the other for companies and other institutions. This is due to the recycling regulations that vary between households and companies. For example, in Finland, households do not need to separate envelopes from newspapers but this should be done in offices.

Recycling and waste companies could deliver stickers to be placed into the garbage bins, which could include quick tips for recycling and remind households about sorting waste. Local authorities and schools could promote recycling, reuse and reduce of paper by giving instructions, arranging campaigns and by following environmentally friend behavior in their daily routines. Companies, on the other hand, could improve their recycling programs, but even more importantly, they should clearly instruct and encourage their employees to rethink the paper use and to accomplish daily office tasks with less paper used. These tips could also be stated in printers and copying machines either arranged by the company, or the manufacturer of the machine.

In table 16, possible instructions of recycling, reuse and reduce of paper are presented. General instructions refer to the information given by public institutions, such as schools and other educational organizations, as well as local authorities. Recycling companies refer to companies that act in collecting and processing of recovered paper. Envelope and news-

paper refer to the markings or notes in the product itself, and packing refers to the package of paper sheets or envelopes. Company specific instructions are related to the recycling programs and eco-efficient manners followed in offices.

Table 16. Instructions for use of printing paper, envelope and newspaper

ISSUES TO BE ADVISED	Printing paper	Envelope	Newspaper
Recycling	<p><i>Company instructions:</i></p> <ul style="list-style-type: none"> unbound the rubber bands but studs and paper clips do not need to be separated do not place the cardboard package among the recovered paper but to the cardboard waste do not put colored paper among white recovered paper replace colored paper with margin colored paper recycle also archive papers recycle confidential papers through companies specialized for this purpose in office, separate white printing paper from newspapers and advertisements and handle it as white paper waste 	<p><i>Envelope:</i></p> <ul style="list-style-type: none"> marked, if not recyclable General instructions and Company instructions: put envelopes to cardboard waste or energy waste General instructions and Recycling Company instructions: in households different colored envelopes go to household wastepaper General instructions: plastics, glue and other dirtiness should be removed before throwing into wastepaper 	<p><i>General instructions, Recycling company instructions, Newspapers:</i></p> <ul style="list-style-type: none"> in households, deliver papers to the wastepaper bin Company instructions: in offices recycle useless papers among newspaper and magazines General instructions, Recycling company instructions: do not put other waste, such as board, plastics or wet paper among newspapers, since they may pollute the total lot General instructions: do not bind the sheaf of paper; the rope does not scatter in the paper handling
Reuse	<p><i>Company instructions:</i></p> <ul style="list-style-type: none"> use a blank side of a previously used sheet or give one side used papers to day-care centers etc. for drawing paper deliver used folders for reuse 	<p><i>General instructions and Company instructions:</i></p> <ul style="list-style-type: none"> reuse envelopes by placing a label over the old address 	<p><i>General instructions:</i></p> <ul style="list-style-type: none"> reuse newspaper for packaging deliver old magazines to schools, hospitals etc.
Reduce	<p><i>Company instructions:</i></p> <ul style="list-style-type: none"> set up printers and copying machines to print and copy documents two-sided do not use fax cover sheets reduce report size preview documents, and print or copy only needed pages circulate one paper around instead of copying masses use bulletin board or e-mail for informing reduce unnecessary mail 	<p><i>Company instructions:</i></p> <ul style="list-style-type: none"> reuse envelopes in internal mail use electronic mail and voice mail 	<p><i>General instructions:</i></p> <ul style="list-style-type: none"> use the public libraries for reading magazines and newspapers circulate newspapers and magazines for reading

4.7 Links to Eco-Design and Environmental Product Declarations

What is Eco-Design?

Eco-Design refers to the systematic incorporation of environmental factors into product design and development. In the United States, it is often called ‘design for environment’ or DfE. (Tukker et. al 2000, 3.)

The main objectives of Eco-Design can be presented as follows (Kärnä 1999, 37):

- Minimizing energy consumption.
- Increasing efficiency of material use.
- Optimizing product life-time.
- Improving recyclability.

- Minimizing the use of environmentally harmful substances in products and processes.

How can Eco-Design and Instructions-for-use support each other?

Environmental information in instructions-for-use (IFU) and Eco-Design have a common goal to decrease the environmental effects of the product. Eco-Design of course has a broader view than IFU as it looks at the whole life-cycle of the product, but anyway the possible use patterns and their effects on the environmental effects of the product should have a large role in Eco-Design.

The objectives of Eco-Design have clear links to the use phase of a product. For many products, the length of life-time is decided by the product owners. Consumers have also much influence on the energy consumption of passenger cars and different appliances and machines in household. Good recyclability of a product, e.g. refrigerator, does not help much if consumers do not take the end-of-life products to the proper waste collection. The harmful substances in a product can cause spillages to the environment if parts and liquids in the product are not treated in a proper way – think e.g. the waste oil, coolant and battery of a car and HCFC-compounds and compressor oils of a refrigerator.

Evidently, eco-design should encompass clear, extensive and motivating user manual of the product. In addition, an efficient combination of different guiding possibilities should be considered for. User manual should of course include all the information and guidelines, and additional Quick-Eco-Guide could give the essential environmental guidelines in a motivating and clear way. However, there are also other possibilities to guide consumers. Figures and short sentences can be attached to the product permanently or with stickers. And what is perhaps most important, the product itself can guide to environmentally sound use. Many passenger cars already have a display for the fuel consumption, and electricity consumption of a refrigerator could also be displayed (also a warning lamp showing abnormally high electricity consumption could be beneficial). A furniture, e.g. sofa, could include paper-formula of the upholstery (e.g. in a pocket) and dimensions of the wadding, so that the sofa could easily be refashioned with a new cover. Possibilities of eco-design in providing consumer guidance are illustrated in figure 13.

Figure 13. Possibilities of Eco-Design in user information

What are Environmental Product Declarations?

Environmental product declaration, EPD, can be defined as quantified environmental data for a product with pre-set categories of parameters based on the ISO 14040 series of standards, but not excluding additional environmental information (ISO TR 14025). EPD's are thus based on life-cycle assessments (LCA), but can present also additional information (e.g. recycling possibilities and energy saving tips for refrigerators).

EPD's belong always to Environmental Declaration Programme that sets requirements for EPD, i.e. which environmental effects should be assessed, which parts of the product system must be included and which rules must be accounted for in the inventory analysis, and what is the format (or type of presentation) in the EPD (Bogeskär et al. 2002). This makes comparisons between products belonging to the same product group (e.g. comparisons between refrigerators) possible. One example of the programs is the Swedish Environmental Declaration system, which has reserved the acronym EPD® for its declarations (Swedish Environmental Management Council 2004).

At the moment EPD's exist in the Swedish system for the following consumer products:

- fridges and freezers
- washing machines

- water mixer tap
- print toner cartridges
- copier and fax machine
- electricity.

In addition, car manufacturers Volvo and Toyota have their own EPD-systems (Bogeskär et al. 2002).

What EPD- information is relevant to the consumer and how it could be expressed?

The principal goal of EPD is to encourage the demand for and supply of those products and services that cause less stress on the environment. EPD's should provide the basis for a fair comparison of products, by the products' environmental performance. Regarding this goal, the use phase must of course be determined so that the results of various products in the product group are comparable. In the Swedish EPD-system it seems to be defined in one way only, using standards and statistics of average life-time of different products. For example the energy consumption of refrigerators is based on standard EN 153. This principle of 'only one type of use patterns' concerns also other EPD-systems basing on LCA (see Bogeskär et al. 2002).

Regarding the consumers, the Swedish EPD's offer now information for:

- comparison of products within a product group,
- assessing the importance of the use phase in the total life-cycle of products.

However, products can be used in various ways, and for example the energy use and emissions of passenger cars depend on the use patterns.

What the EPD's could do, but miss at the moment, is to offer information for:

- comparison of different use patterns, which affect e.g. the length of life-time and energy use.

If the presentation of multiple consumption patterns in EPD's is assumed to cause too much extra trouble to the verification and certification, one could also have a 'lighter control' for this part of EPD: it could be a voluntary non-certified part of EPD, or totally outside the actual EPD-format but however recognized and described by the EPD-system as a possible way to develop the use and presentation of EPD data.

EPD's containing data and figures of different use patterns would be valuable a part of IFU's, e.g. in Internet. They could even be thought as being a section in the user manuals. In user manuals, one could show first

the environmental effects of 'typical standard-following' use in relation to the other stages of the life-cycle and the total life-cycle. This could be shown e.g. in one table and one figure. In addition, in another set of one table and one figure one could show how different use-patterns affect the environmental effects.

Another problem related to EPD's should also be mentioned; namely the lack of reference values. When communicating the results of LCA to consumers, like EPD's try to do, it would be important to indicate somehow the importance of the emissions given as equivalent values (e.g. kg CO₂-equivalents for greenhouse gases). One possibility is to present normalized emissions in the figures, using emissions in the whole country as the divider.

5. Discussion and Conclusions

5.1 Information Needs, Tools and Actors in the Product Categories

Energy consumption, length of life time, daily use practices and disposal of products are the primary aspects influencing the environmental burden that products create in the use phase. These aspects have a different weight in each of the four product categories examined in the study.

Energy-consuming products – Main aspect: Energy consumption

In this category, common types of household products are cold appliances, stoves, other kitchen appliances, space heaters, washing machines, clothes dryers, air conditioners, television, personal computers, smaller home appliances and lamps. This category encompasses also passenger cars, other vehicles and machines like lawn mowers.

In the DEEP –project the use phase of the product was emphasized as the basis for effective product information schemes in this category. As the authors note, no label gives guiding or 'educative' information of correct and ecologically sound product use to consumers. They propose that guiding could be done with a few text notes, and that it also might be combined with hardware eco-design solutions (e.g. refrigerators giving an alarm signal if they are opened for too long). They also state that the main stakeholders for this category are producers, distributors and users. In particular, distributors might play a crucial role in informing and 'educating' consumers as well as putting pressure on producers. Furthermore, due to technological complexity of durable products, other stakeholders and other life cycle phases like the supply chain, dismantling and end-of-life are also important. (Frankl & Pietroni 2002, 56-57.)

In our study, passenger cars and refrigerator-freezers were examined. The general results are applicable to the other energy consuming durable products too, at least the ones that have high energy consumption and complex functioning, and require fairly thick user manuals. Basically all the same environmental aspects are valid for energy consuming home appliances. Common to all home devices is, for example, the need for energy reducing actions and the need for regular maintenance operations to guarantee the proper functioning and long life time of the product.

For energy-consuming products the primary user information is needed about energy reducing use patterns. Information on energy costs and savings may also be beneficial to motivate consumers. Prolongation of life time, on the other hand, could be contradictory to energy savings.

Although a general recommendation is to extend the products' life time, the increase in energy consumption of old devices (over 10-15 years) can sometimes cut down the benefits gained from the product life extension. Therefore it is important to recognize the defects in aging products causing extra energy need and be aware of the needed repair or correct time to change the old product. Sometimes it is also possible to move the product to less intensive or part-time use, for example to 'summer-cars'. In this case the instructions for lay down periods become very important.

Disposal of products in this category may cause severe environmental impacts since these products often include hazardous fluids and materials. Due to directive of producers' responsibility coming into force in electronics and car industry, the responsibility of disposal and recycling of products is mainly to be shifted from consumers to manufactures. However, a threat still lies in the form of toxic fluids, other chemicals and spare parts that can be discarded during the use and maintenance operations done by the owners themselves. Therefore adequate information on disposal of spare parts and chemicals is important.

Consumer information should be considered already in the design phase. Eco-design has in many cases focused on cleaner production, resource conservation, energy efficiency, recyclability and extension of product life time but it could evidently focus more on the environmental guidance given by the user manual and the product itself. These possibilities should be considered alongside the design of the product as well as when product standards and eco-labels are developed. For example, there are many possibilities in cold devices to guide users by assembling alarm buttons and reminding stickers to the product.

The members of the feedback groups of energy-consuming products claimed that even too much responsibility of environmental advising is laid to the manufacturer and the user manual, since the first priority of the user manual is to guarantee the correct and safe use of a product, after which comes the advice about environmental issues²³. This does not mean that environmental issues should not be advised in the manual but the focus is on the safety issues. This would place more responsibility to the other actors to provide complementary environmental advice.

Products in this category are often large in size, relatively high in price and often sold in shops or retail markets with special knowledge of the products, for example in home appliance stores and car shops. In addition, usually the purchase of these products is economically very important for buyers and therefore they are likely willing to use some time to select the specific product. Typical is also that these products are often presented in fairs and exhibitions of home related issues and in car shows. These places serve an important arena where the instructions of

²³ In many cases, however, the environmental issues are closely related to the instructions of safe and correct use of a product, for example, the cautions about CO emissions and battery acids.

environmentally sound use of such products could be placed and promoted. For example, a fair of home supplies²⁴ showed that the energy consumption issues of home appliances were not informed although there were 15 representatives of home devices, many of which were agents for cold appliances. In these kind of fairs where the attendance reached almost 50 000 visitors²⁵, energy saving information of home appliances should have been presented.

The shopkeeper and the seller could play a major role in advising consumers about environmental issues. Especially, when the product is complex and contains many environmental aspects the seller should invest time to communicate practical and objective environmental information to the new product owner. For example, the seller could introduce the basic how-to-use instructions, and additionally tell the user about environmental and economical benefits from energy saving use patterns and other environmental aspects. The seller could also encourage the buyer to study the manual, and to find more information for example through Internet, i.e. raise the status of user manuals and eco-guidance. For this reason, it could be useful to place an Internet link in the web pages of the seller, which would easily direct the user to the advice on environmental aspects of the product. Also posters telling about energy savings could be placed in the shops and trade fairs.

It appears that consumers are quite poorly aware of the financial benefits of energy saving. Thus, it is likely that increasing the awareness on the economical gains due to energy saving could also motivate consumers to behave in environmentally sound way and would also give credibility to the environmental claims. However, the direct savings in money are difficult to give in user manuals due to the changes in energy prices, but could be advised otherwise. The role of consumer centres and energy organizations as well as public media is essential.

Information about energy savings already exists in many sources such as in the Internet, articles, statistics and other forms of written documentation. The challenge is therefore, to deliver this existing information to consumers in the most efficient way and make their access to appropriate information easy. Indeed, the roles of sellers, retailers and industrial organizations in the information delivery were highlighted in the feedback group discussion and also in a seminar of car industry²⁶. Eco-guidance provided by the seller and maintenance staff during the customer service could even be declared into the environmental program of the seller's company.

Energy intensive products are often complex in nature with many functions and parts. Therefore comprehensive user advice is needed to

²⁴ Home 2004. Helsinki Trade Fair Center, 1.4.2004.

²⁵ During 1.4. – 4.4. 2004, there were 48 112 visitors (<http://www.finnexpo.fi/exhibition.asp?Id=1114>).

²⁶ Seminar of The Finnish Central Organization for Motor Trades and Repairs, 25.5.2004 Congress Center Vantaa.

guarantee the correct and safe use. This information is typically given in a user manual accompanying the product. The Standard for preparation of instructions (IEC 62079) set recommendations for instructions for use, e.g. for the content and presentation of the information. Items to be informed include for example special features of the product, e.g. energy consumption, emissions, noise, waste, other environmental aspects of using the product and information on safe disposal of waste. Also requirements for information on maintenance and cleaning include many issues that are important also from the environmental point of view, e.g. regular checking, fault diagnosis and storage. In addition, this standard gives a view of the presentation that the instructions for use should follow, e.g. use of colors, text and terms, illustrations and general quality. However, this standard could also develop a special section about presenting environmental issues. Criteria defined in the standard IEC 62079 was applied and modified in our study to elaborate the criteria for assessing environmental aspects in user manuals (Figure 14) and their presentation (Figure 15).

Due to the complexity of the products, the manuals are often thick. This may also be one reason why the user manual is often ignored and read only after the product functions improperly or gets broken. And even if the manual was not very thick it is still studied only selectively finding a solution to a specific problem, but not in advance, which would prevent many unnecessary damages that shorten the product's life time. It is evident that in this case, also the environmental information does not reach the user and possible environmental benefits will not be gained. Thus, one solution would be to provide a quick-guide on environmental issues.

What environmental information user manuals should include...

- **SOURCES OF ENERGY CONSUMPTION AND ADVICE ON HOW TO USE THE PRODUCT IN THE MOST ENERGY EFFICIENT WAY**
cars: e.g. driving style, servicing, engine pre-heating
cold appliances: e.g. location, cleaning, temperature
- **ENVIRONMENTAL ASPECTS AND RELATION OF THE PRODUCT USE TO THE ASPECT**
e.g. cars: climate change and smog
cold appliances: e.g. ozone layer
- **ENERGY CONSUMPTION IN DIFFERENT CONDITIONS**
e.g. l / 100 km – cars
kWh / year – cold appliances
- **SOURCES OF NOISE AND ACTIONS TO REDUCE NOISE**
- **INFORMATION ON EXTREME CONDITIONS AND RESTRICTIONS FOR USE, AND ADVICE ON HOW TO PREVENT THE IMPACTS OF THESE CONDITIONS ON THE PRODUCT**
e.g. winter use, part-time use, long term lay down and storage
- **THREATENING FACTORS THAT SHORTEN THE PRODUCT'S LIFE TIME, AND HOW TO PROTECT THE PRODUCT AGAINST THESE FACTORS**
e.g. corrosion prevention
- **INFORMATION ON MATERIALS INCLUDED IN THE PRODUCT**
e.g. heat transmission materials, paints, other chemicals
- **INFORMATION ON EMISSION (CONDITIONS)**
cars: e.g. when driving with cold engine, idling
cold appliances: e.g. when the device damages (heat transmission material release)
- **DISPOSAL POINTS FOR DIFFERENT KIND OF WASTE**
e.g. package waste, fluids, chemicals, spare parts
- **INFORMATION ON PRODUCT'S RECYCLABILITY, AND ADVICE ON HOW TO UTILISE THE MANUFACTURER'S TAKE BACK OFFER**
- **CONTACT DATA TO ADDITIONAL ENVIRONMENTAL INFORMATION**
- **CARE OPERATIONS THAT THE USER CAN DO + INSTRUCTIONS**
e.g. regular checks listed and other maintenance operations and thorough washing instructions for all materials of the product, list of recommended (and environmentally sound) care products and cleaners, information on non-suitable cleaners and items that could damage the materials
- **MAINTENANCE AND CLEANING OPERATIONS THAT THE USER SHOULD NOT DO (LISTED)**
- **FREQUENCY OF REGULAR SERVICING AND OPERATIONS INCLUDED**
- **FAULT DIAGNOSIS TABLE INCLUDING POSSIBLE FAULTS, REPAIR SOLUTIONS AND REPAIRPERSON SUITABLE TO DO THE FIXING**
- **CONSEQUENCES OF IMPROPER CARE OR IGNORANCE OF INSTRUCTIONS**
e.g. release of transmission material or hazardous chemicals if treated or disposed properly

Figure 14. Criteria for assessing environmental aspects in the user manuals of energy-consuming products

Figure 15. Criteria for assessing the presentation of environmental aspects in the user manuals of energy-consuming products

Energy-passive durable products – Main aspect: Prolongation of life time

In the category of energy-passive durable goods, products such as furniture, textiles, footwear, and building materials are included. The focus is on the prolongation of life time by correct care and repair of products. Although the product itself does not need energy to function, the consumption of energy and chemicals in wash and care operations are essential for some of the products, like textiles. In addition, reuse and recycling are major concerns when discarding the products.

In the DEEP –project the authors stated that for this category the guidance should be provided for the end-of-life phase but did not regard the best maintenance and extension of the product life time. They also recommended targeted and focused awareness campaigns for this product category. (Frankl & Pietroni 2002, 57.)

In our study, textiles and sofas were examined as examples of this category. This category includes an excessive amount of different models of textiles and furniture and therefore the results are applicable to all the products containing textile materials and to other furniture as well. The criteria for assessing environmental aspects are shown in figure 16.

The main focus in consumer instructions was on the washing declaration that should provide the user with adequate information on textile care. Additional words in washing declaration may in some cases be needed to clarify specific care procedures. Also furniture includes textiles that need to be washed, for example the divan cushions, and therefore the washing declaration is important also in other textile products than clothes.

Discarded energy-passive durable products could in many cases be recycled or reused. Therefore it is important that the manufacturer provides information on material content so that the end user could easily reuse the material or direct it to recycling. In addition, this would be beneficial to the consumer in order to modernize or repair the product. A lack of information about included materials is a barrier to efficient end-of –life management of the product.

For products in this category, the feedback group saw that much more instructions for use could be available. In case of textiles the information lies mostly on the washing declaration although some materials might need special attention and additional markings. In case of furniture, it seems that in most cases the instructions simply do not exist.

Selling of textiles and furniture is often centralized through large retailers or chains of stores. Therefore these large retailers also have a great potential to influence the user information. For example, in case of textiles, the seller plays a key role in advising the consumers about correct care operations. Staff training ensures that the sellers are aware of the environmentally sound care practices and helps them to advise consumers. In many cases, environmental and economical benefits can be gained only by applying some easy daily routines.

In addition, the basics of textile care are evidently taught in schools. Newspapers and magazines can help to maintain and complete this basic knowledge. These actors were seen important in raising the awareness on sustainable use patterns generally.

Figure 16. Criteria for assessing environmental aspects in instructions for use of energy-passive products

Non-recoverable consumable goods – Main aspect: Daily use patterns

The category of non-recoverable consumable products includes products that do not have a recycling system and thus become household waste. Therefore the informative focus is on the use practices and disposal of the product and its package. This category encompasses many kinds of liquids, chemicals and cleaning agents that go directly down the drain. Also packages that do not have recycling system, e.g. plastic packages in many regions, can be included into this category. (Frankl & Pietroni 2002, 55.)

The main environmental burden of cleaning agents is related to the harmfulness and toxicity of chemicals, as well as to the empty packages. Although the products themselves have become more environmentally sound including less harmful substances, they are not harmless. Thus, the environmental concern still relies on the amounts of product used, and this is to a large degree dependent upon the consumer.

In the DEEP –project it was concluded that product information schemes should primarily focus on the production phase and on the primary resources involved for this product category. It was also thought that users can make the best purchase but afterwards, their behavior has no influence. (Frankl & Pietroni 2002, 54.) This can be the case e.g. for such packages which do not have a recycling system.

However, this view was challenged in our study particularly on the case of different cleaning chemicals, for which dosing and the correct purpose of use are critical. The results of the examined products, i.e. laundry detergents and all purpose cleaners can be applied to many of other cleaning agents as well. Discussions in the feedback group addressed the difficulties encountered in providing detailed user instructions in this category. In many cases the package is small in size, which makes it almost impossible to give all the detailed data about environmental issues, in addition to the safety and marketing claims. The small font and limited space for instructions may make the instructions confusing and the relevant information is not clearly found. In many cases this is also due to the many different languages in the package since some of the brands are sold in many countries and the instructions for use are rarely localized to a specific country.

These products are often consumer goods that are sold in many super markets and grocery stores where there is no personal selling available and the amounts of brands and labels is enormous. Thus the products are often bought and also used routinely without checking the instructions regularly. Therefore it could be useful to bring the relevant user information to the buyers when they are buying the product, for example in the form of posters in the product shelves in the shops, for example about the local water hardness in the area. This could also capture the consumers' attention to recognize that there really exist important instructions that should be considered during the routine use of this product.

The criteria for assessing environmental aspects in the instructions (i.e. package) are shown in figure 17.

Figure 17. Criteria for assessing environmental aspects in the instructions of cleaning agents

Recoverable consumable products – Main aspect: Disposal

This product category includes products with existing recycling system. Typically this category encompasses different paper products, such as printing paper, newspapers and other paper products. Also other materials that can be recycled are included in the category, such as cardboard and glass. These products do not cause their environmental burden in the actual use but before and after it. The major concern regarding to the use and disposal phases is to take the material into the proper collection and to reduce the impurities in the collected materials.

In the DEEP –project, the role of consumers was emphasized for this product category because consumers can whether take the used and scrapped product to separate collection or not. It was proposed that below eco-labels a short note could be given, e.g. "recycling paper avoids tree-cutting and greenhouse gas emissions from landfill" or "compressing packaging waste makes recovery and recycling of materials easier". It was also concluded that in addition to manufacturers and consumers, local authorities, and recyclers (e.g. for packing materials) might also

play a crucial role to effectively decrease the overall life cycle environmental impacts. (Frankl & Pietroni 2002, 55.)

In our study, examined products included printing paper, newspaper and envelopes. One of the key lessons was that the recycling instructions for paper should be twofold, i.e. there should be more detailed instructions for work places and more general instructions for households in order to make the recycling efficient. Although more advice could be given to households about assorting paper products, this more detailed instructing might lead to confusion and overall reduction of the amount of recycled paper. The role of instructing the disposal of recyclable products was mainly appointed towards recycling companies, authorities, work-places and schools. In addition, campaigns for recycling organized by authorities were emphasized.

Aspects common to all product groups

Consumer information can be given in the user manuals as direct advices and facts to influence the initiative environmental impact of use such as energy consumption, or in a more general context to influence the use patterns and consumer behavior such as reducing the use of products. It is obvious that the manufacturer's priority is not to reduce the use of the product but to advise the user about environmentally sound use. Manufacturers in the feedback groups underlined the importance to recognize the kind of information that enables the consumer to realize which environmental problem should be given priority. If too much detailed information is given, this leads to confusion and the essential environmental aspects will not be realized by the users.

Manufacturers also saw that in many cases consumers would find the issues about their safety and health as well as the effect of the issue to their financial welfare more appealing than the environmental issues. In many cases, however, the environmental benefits could be presented also in the form of health, safety and financial issues. For example, talking about savings in fuel would be a more concrete language and more familiar issue to consumers than talking about reductions of the CO₂ – emissions. Consumers are likely more willing to act if they realize that in addition to the environmental benefits they gain major economical benefits in the long run, so that saving environment helps them to save money.

The public sector, non-governmental organizations, schools and mass media could support information campaigns to encourage consumers to change consumption patterns. Media is full of advertising that generally appeals to consumers in terms of attempting them to buy and consume more. In this complex context it is difficult to place the environmental message in a way that appeals to the consumers' decision making and enables them to adopt new consumption patterns. Environmental issues could be brought close to consumers by using positive and friendly sentences and reminders. Although the information should be encouraging

and positive in sound, also the drawbacks of incorrect use should be illustrated.

The importance of personal communication of the seller is highlighted in the product categories where energy consumption or prolongation of life time are essential (e.g. for energy-consuming and energy-passive durable products). In addition, the role of retailers in placing the information available in local super stores was seen important in case of non-recoverable consumer products. These issues illustrate the importance that the information should be exactly there where the consumer is. If the environmental information is placed in a store the consumer is likely to pay attention to it. The same influence could be gained by posters that could be placed close to the products in the stores. In case of recyclable products, this manner would work by placing the instructions to the recycle bins and collection points, as well as to the containers of household waste.

Although the media (TV, radio, newspapers and magazines, Internet) play a central role in providing consumer information, also schools, non-governmental organizations, authorities, private companies and work places were seen important. A major responsibility was placed to schools in advising about current environmental issues and environmentally sound household practices. In addition, more effort could be placed to workplace training, for example in recycling of paper and reuse of envelopes.

The opinion of the feedback groups was that the information should be clear and simple enough to be efficient. It should include also the justifications, or practical background either in environmental, safety or financial terms that would motivate the consumer to act accordingly. This kind of efficient environmental information can be produced only through close co-operation among actors in the information network. As the information has to be collected from many sources and presented by many channels, it is definitely difficult to determine the exact duties of all parties. However, possible free riders in the information channel should not be feared too much. Co-operation is needed between manufacturers, retailers and education as well as administration. Activity of media in this field would be of primary importance. The relationships of tools and channels in improving eco-information are illustrated in figure 18.

Figure 18. Tools and channels for improved eco-information

5.2 Proposals for Further Actions

In developing proposals for further actions, we recognized the need to raise the general status of user manuals, as well as the need to improve their quality regarding the environmental aspects. User manuals and other kind of user instructions should be paid more attention to so that people would consider them important. And the instructions should, better than today, present all the important environmental aspects of product use, and preferably in a clear and motivating way.

The study raised many ideas about actions needed to promote the status and 'eco-development' of IFU, instructions for use. These include quick-eco-manuals for various products, Internet-site 'Eco-Manuals for Consumers', seminars, a contest of best IFU, and proposals to the standardization organizations to add more focus on the environmental aspects in the standard of IFU and in the standards of various products.

It was not easy to find effective ways to promote the use of IFU among consumers, as well as their activity in asking for environmental aspects of product use, but we propose that a leaflet and accompanying press releases could raise interest among consumers as well as among

media, manufacturers and sellers. Finally, co-operation with school administration could be developed.

What are Quick-Eco-Guides?

It is evident that quite few people ever read through thick user manuals, e.g. such as the ones of passenger cars. Together with such manuals, a separate Quick-Eco-Guide could be effective. It would include all the environmental aspects and eco-guidance of the product use. And in addition to environmental motivation and guidance, it could refer to economical savings to consumer due to lower energy costs, longer life-time, etc. In addition to cars, such quick-eco-guides could be beneficial to various home appliances like refrigerators and washing machines, which may also have quite thick user manuals.

Eco-guidance is already found as separate sections in some user manuals, compiling the relevant environmental aspects of the product, and giving the page numbers where more details of each aspect is given. Examples of such pages could be helpful to the developers of the user manuals.

Who could make the Quick-Eco-Guides?

The development of a separate Quick-Eco-Guide for a product group evidently would best suit to the manufacturers and industry associations. Actually, a member of the feedback group for cars, The Finnish Central Organization for Motor Trades and Repairs (AKL), already started to plan a project in Finland, which would produce such a manual for passenger cars. The guiding leaflet would be given to all buyers of new cars, and it would also be on hand to all car users in service stations, trade shows etc.

At the same time as such leaflets would be produced, the corresponding part in the user manuals could be developed, so that proposals would be given for a section in the user manual that compiles the relevant environmental aspects and gives the page numbers where more details of each aspect is given.

What the Nordic Group could do for Quick-Eco-Guides?

The Nordic group could act as an initiator and develop an informative channel, that would motivate the development of the Eco-Guidebooks for the various product groups.

The Nordic Group could send this report to the relevant industrial associations and central associations of retailers in each Nordic country, proposing that the companies could consider developing the user instructions related to their products, and referring to the relevant pages in this report. It would be good, if at the same time reference could be made to an Internet-site, which would compile the work being done in the field of eco-guidance of product use (see below).

How the Nordic Group could motivate the manufacturers to improve the instructions?

An Internet-site (e.g. 'Eco-Guides of Product Use for Consumers') could be an effective way of delivering information to the manufacturers, combined with sending a letter and the report to the central industrial and trade associations in each country. The idea would be that the central associations could then deliver information to their member companies, giving the www-pages as a source of information.

The web-pages could include few pages describing the importance of user instructions in connection to the environmental problems associated with different products. In addition, it could include the pdf-version of this report, and idea of the Quick-Eco-Guides. In addition, material directed to consumers (e.g. a leaflet, see below) and a competition for manufacturers (see below) could of course be announced here. A section could be owned to the development projects of the Quick-Eco-Guides and other 'eco-instructions' by the manufacturers and retailers.

How the eco-guidance by the sellers could be improved?

It is evident that sellers could have much larger role in guiding consumers. This would be especially important in the case of passenger cars and home appliances with long expected life-time, like refrigerators and washing machines. The guiding would be helped by supportive material like the above proposed Quick-Eco-Manuals. User manuals include, of course, the same information, but using of them in connection with the product selling may be challenging as they can vary a lot from model to model.

In case that retailers and sellers have environmental programs or management systems, they could be asked about the eco-guidance given to the buyers, because it is clear that this is an important environmental aspect of their organization and should be included in such programs. For example, many car retailers and shops have environmental programs or management systems, and advising of environmental guidelines when delivering the product to the buyer should inevitably be included in the system.

When sending this report to the relevant industrial associations and central associations of retailers in each Nordic country, the Nordic Group could remind that it would be important to stress the guidance given by the seller when buying and delivering products to the consumers, and that this should be always a part of environmental programs and management systems.

What could be done for the Standard of IFU and product standards?

Standard of IFU (IEC 62079) names many aspects that are in fact relevant environmental aspects. However, the standard does not refer to environmentally sound use of products. Taking the environment into account

could be stressed regarding the following aspects named in the standard: Environmental aspects of using the product, product disposal measures, energy consumption and conditions, noise, gases, waste, radiation, maintenance and cleaning by users, maintenance and cleaning by qualified persons, fault diagnosis, repair, and storage of the product.

In product standards, we ask for more systematic handling of IFU, and especially environmental aspects of IFU. Standard of IFU and the 'Environmental Checklist' offered by BOSS (CEN 2004) could be used as a basis in the assessment of the environmental aspects that should be guided in the user manuals. The checklist includes the following aspects: Resource use (durability, recycling); Energy consumption; Emission to air; Emission to water; Waste (durability, recycling); Noise; Migration of hazardous chemicals; Impacts on soil; Risks to the environment from accidents or misuse. Note that many examples given in the checklist include instructions to be presented in the user manual.

What the Nordic Group could do for the Standard of IFU and product standards?

ISO and CEN and the national boards are key actors in standardization. The Nordic Group could send the report with a cover letter to ISO and CEN indicating the wish to promote the presentation of environmental aspects of product use in the standard of IFU as well as in the various product standards. Reference could be made to the relevant pages in this report (i.e. Chapter 5.1).

How the Eco-Design should consider good user manuals and other eco-informing of the consumer?

It is evident that eco-design of a product should encompass clear, extensive and motivating user manual. In addition, an efficient combination of different guiding possibilities should be considered for, covering at least the user manual, possible quick-eco-guide and material in Internet, figures and short sentences in the product, and the guiding properties of the product.

The Nordic Group could send this report to the IPP secretary of EU and DfE-program of US-EPA, as well as to e.g. the Center for Sustainable Design in UK. The cover letter could refer to pages 70-71 of this report.

How Environmental Product Declarations could include the effects of different use patterns?

In order to promote environmentally sound use of products, it would be useful to show to the consumers what are the environmental effects of guzzling, as well as typical and ecologically sound use of products. The EPD's could include data of these three ways of using the product (for relevant products).

The Nordic Group could send this report to the Swedish EPD-system together with a cover letter referring to pages 71-72.

Would seminars raise interest to IFU?

Seminars are of course one way to disseminate and discuss the development of eco-instructions together with key actors in this field. These key actors include manufacturers and traders, central associations of industry and trade, non-governmental organizations, and administration in the fields of consumers, products, environment and education.

In order to confirm follow-on of discussion and long-term effects of such seminars, the Internet-pages should exist and be shown in the seminar. In addition, if the contest of best IFU (see below) could be announced in the seminar, this would certainly rise interest towards the seminar.

Would a Nordic Contest of Best IFU raise interest to IFU?

In order to reach visibility for the idea of good consumer eco-guidance among manufacturers, trade and consumers, a contest could be a way to proceed. The criteria of good user manual could follow the criteria developed in this study (see Appendixes 1-6). The product-groups could perhaps be restricted to one, e.g. furniture which are hardly at all instructed while being an important product group in each household and having important care and maintenance and recycling aspects to be instructed. (It is of course possible to have classes for different products, so that prizes would be given in each class.)

The Nordic Group could initiate a project, in which the Contest of Best IFU would be organized. The project should establish the organization and communication, i.e. secretary, judges, the publication of the Contest, the preparation of the various documents needed, etc.

Is a prize needed? We suggest that the publicity gained by the participants and especially the winners would be enough. However, in this case the advertisement of the winner and other good examples should be planned beforehand and informed clearly to the potential participants, so that the benefits would be clear and outstanding. And enough time should be given, so that improvements to the present user manuals could be possible (notice that e.g. for furniture some of the manufacturers would start from practically zero-situations regarding user manuals).

How the consumers could be approached?

It would be important to direct information also to consumers, so that they would better know what to expect and ask when buying a product, using it for the first time, and looking for instructions in the product, package, and attached documents. If consumers were better informed of requirements for user manuals, this would certainly be noticed also by the

manufacturers and retailers, increasing their motivation to develop the instructions.

We propose that a two-page leaflet and the same material in Internet could be a start, supported by a press release about the publication of this leaflet. This would be a way to address the consumers, and at the same it could raise the interest of the media.

The first page could include e.g. the following ideas:

Were you advised how-to-use your product eco-reasonably?

Did the seller tell you?

Did you read the user manual?

Was the know-how there?

Do you remember was it taught in the school?

Have you read it in the magazines or newspapers?

A background figure could include different products and ecosystems, nature, as if products were used in the nature, giving idea of the importance of proper use for the nature.

The second page could include some important aspects of different products:

Use them eco-consciously – regard energy use, length of life-time, and harmful chemicals

Cars

- *how to diminish fuel consumption and effects on climate change?*
- *how to diminish the harmful emissions to air and acidification and smog?*
- *how to extend the life-time of a car and diminish resource consumption?*
- *how to avoid chemical spillage and ecotoxic effects?*

Furniture

- *how to extend the life-time of the furniture and diminish resource consumption?*

Cleaning chemicals

- *how to dose and dispose them right and diminish ecotoxic effects and eutrophication?*

How to educate the youngsters to environmentally sound use of products?

We propose that the Nordic Group could send the report to the administration of education in each country. Although the environmental aspects of the various products in households are assumable well taught in schools already now, we wish to stress that the basic knowledge and know-how regarding reasonable and environmentally conscious use of various products in households is often giving mainly in school. In the cover letter, reference could be made to relevant pages in this report.

5.3 Conclusions and Suggestions for Further Study

This study examined the extend to which instructions for use, or the product itself, advise consumers on environmentally sound use of products. For products that include user manual (cars and refrigerator-freezers), most of the important environmental aspects, energy consumption and prolongation of life time, were advised. Especially, the energy efficient use of products was presented, as well as correct maintenance and actions that prolong the product life time, e.g. corrosion prevention for cars.

Areas for improvements although exist for all the relevant aspects to be considered. For example, advice on disposal of different fluids, materials and parts was somewhat lacking for both the cars and refrigerator-freezers. Although many manuals stated that waste should be disposed properly, the actual advice was not given. However, also an opposite examples existed, which listed the collection points for different kind of waste.

The way the information was presented varied a lot. For example, in many manuals the information was scattered and the most important issues were difficult to find. Summarizing tables would therefore be as of great importance, e.g. a table for regular checking, long term lay-down, winter use and sources of noise, energy consumption and threatening factors. Overall, the big picture of environmental aspect and the use of the product was missing. For example, explaining the connection of environmental instructions and product use to the relevant environmental impact, e.g. climate change.

For furniture and textiles, more environmental information is definitely recommended. For sofas, a user manual rarely exists and thus it would be important to develop these for furniture; the material content and care instructions should be given so that the furniture would be easier to modernize, repair or recycle. For textiles, although the washing declaration gives the most important washing instruction, additional information could be delivered in a form of attached one-page leaflet containing instructions that are beneficial in order to prolong the textile's life time.

In the product group of cleaners, clear presenting of dosing information according to water hardness is important. In some of the packages this was not presented clearly enough. Retailers and water supply authorities could provide the information on water hardness in the specific area. As the packages are small in size, more information on the use of the product could be in the Internet, placed in a way that is easily available.

For paper, the role of recycling companies was emphasized as communicators of the advice on recycling of different types of papers in offices and households. General advice on sorting and recycling of e.g. envelopes is difficult to make since collection systems and sorting advice vary regionally, and both the households and work places would need specific instructions.

It seems that there is a trend towards more user information to be available. In this context also the role of the seller is stressed in delivering the information. There is an ongoing pressure to include all possible information into the user manuals even if some of the most important points might be ignored, or the manuals become thick and uneasy to read. Therefore, the role of the seller would be to explain in the purchase situation the most important environmental issues and encourage the user to study the manual. However, this study showed that good environmental advice do not necessarily need thick user manuals. With clear statements, justifications and colours environmental information can be well delivered.

Suggestions for further study

Environmental information aims to shift the current way of living towards more sustainable direction, where the key determinants are changes in product characteristics and changes in household use patterns. We assumed in this study, that consumers are willing to use products in an environmentally friendly way and are able to study the instructions in a moderate time. In reality, however, delivering environmental information is much more challenging if the respondents are uninterested about the issue. Even if the message was formulated and communicated well, it may not result in indented action or change in the use patterns because there exist great differences in how consumers receive the message. Some consumers may need more information and encouragement while others are already motivated and interest of environmentally sound use behavior. This is a major consideration when campaigns, advertisements, and other informational messages are elaborated.

It should be recognized that general consumption patterns and consumer behavior in the use phase are in many cases a consequence of social process and influenced also by many factors such as wealth, attitudes, motivation, time factor²⁷ and other interests. Many of such issues in

²⁷ See: Jalas, M. 2002. A time use perspective on the materials intensity of consumption. *Ecological Economics* 41, 109-123. Elsevier Science B.V.

household behavior may not be well understood. For example, frequency of replacement of products, and whether this timing of product replacements has shortened due to the innovation of new and more complex products, needs to be clarified. And further, although there is a call for long lasting products, comparisons of the life time of newest products between the older products would be worth examining to clarify whether the life time and durability of products really have increased.

In addition, it would be interesting to examine the consumer related factors behind the cycles from purchasing to the point when the product is abandoned. Some studies²⁸ indicate that the age of the head of the household and the age of the durable are significant factors of replacement of home appliances. Particularly, the older the head of the household, the less likely the durable will be replaced. Instead, economic factors such as monthly income, household credit ratings and operating costs of the appliance were found to be less significant. (Fernandez 2001.) It is obvious that future research work is needed to examine the heterogeneous group of consumers and its behavior patterns in order to penetrate new concepts of use successfully.

Commonly used household products were examined in our study. Today, however, due to the fast penetration of information technology, products such as personal computers and different multimedia applications are likely to increase in household representing significant electricity consumption. It is estimated that 70 % of all environmental effects in a computer's life cycle occur in the use phase (OECD 2002b, 9). An area of further research could be the electricity reducing actions of IT- and entertainment applications.

This study concentrated on easily available instructions, i.e. user manual and the physical product or package. In addition, the Internet pages of manufacturers of the examined products were visited. However, in the future, Internet will probably become even more common way of delivering consumer information than today. The possibilities of Internet and other electronic forms in delivering environmental user information could be examined in depth. A recent study carried out by Swedish Consumer Center (2002) indicates that there are shortcomings in instructions provided in the web pages of several manufacturers of electrical appliances. One of the flaws was that there exist a great amount of information on the page and thus it is difficult to find the facts and advice needed. In addition, the environmental information given is facile and underlines the environmental achievements of the manufacturer. However, if a declaration of environmental characteristics is found, it usually is fairly good. (Konsumentverket 2002, 6.) It would be worth examining how consumers are able to utilize the environmental information delivered through other channels than the product or related documents, and how this information could be improved.

²⁸ See also: Raymond et al. (1993).

In addition to the information instrument, there are factors such as economic and administrative instruments that directly or indirectly guide consumer behavior and product use. For example, the impact of high or low taxes in fuels or electricity may effect consumers' behavior in the use phase, and reduce or increase the consumption and daily use of energy intensive goods. It is estimated that a 10 % increase in the price of petrol will, in the long run, result in 10 % decrease in fuel demand (OECD 2002*b*, 19). In this study, however, only the information instrument was considered and these consequences of governmental administrative actions were not measured, but in order to implement new use patterns successfully it would, of course, be essential to examine also the effect of prices and taxes to the use patterns.

User information in its different forms could be effective tool in promoting environmentally sound use of products. The common opinion of the feedback groups was, however, that too detailed or complex environmental information may even be a barrier to link the advice to action. In practice, it is rarely worth publishing all the detailed data in the instructions. Thus, it would be of great importance to know how much environmental information is optimal for consumers to adopt and follow. Similarly, an interesting question arises on how much environmental information is optimal for the manufacturer to produce due to the costs of providing the information, or due to the possible indirect consequences to the product demand if too much information is given. A further study would be needed to examine the balance of environmental information given by manufacturers and utilized by consumers. Finally, close to this, incentives behind the behavior of manufacturers and consumers would be worth examining. For example, do companies have enough incentives to adopt eco-design or to produce environmental information, and what kind of incentives could be used to encourage manufacturers to deliver all the essential eco-information. Consequently, also the consumer incentives should be examined i.e. how the consumer can be motivated to acquire all the relevant environmental guidance. Currently, manufacturers and consumers may not always find the sufficient incentives to behave environmentally friendly. Clear and well understood signals to households are required as well as attractive incentives to companies to produce the relevant environmental information.

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Appendix 1 Environmental advice found in user manuals of passenger cars

The relevance of each instruction to various environmental aspects is shown by gray color²⁹ and the number indicates in how many of the 12 manuals the specific instruction was found.

1A) ECO-DRIVING

INSTRUCTIONS	SOME JUSTIFICATIONS OF THE INSTRUCTIONS AND RELEVANCE TO THE ENVIRONMENTAL ASPECTS BELOW				N =
	Energy Consumption and CO ₂	Life Time	Emissions of NO _x , VOC, CO, PM _x	Noise	
Planning and monitoring					12
Plan the driving route and time, and avoid driving in heavy traffic.	<i>During rush hours the fuel consumption increases 70 %.</i>		<i>CO created in the fuel combustion is related to fuel consumption.</i>		4
Avoid driving short trips (< 5 km). /Recognize that short trips (cold engine) consume more fuel than driving at normal functioning temperature.	<i>Cold engine consumes 30 – 40 l / 100 km. Engine has not reached its functioning temperature until after 4-8 km drive. Prefer walking and cycling for short trips.</i>	<i>Cold starting burdens the engine and battery.</i>	<i>Catalytic has not reached its proper functioning temperature.</i>		7
Avoid driving in bad road conditions. /Drive carefully in bad road conditions.	<i>Curves, hills, rocks and wet roads increase the fuel consumption.</i>	<i>Rocks hit the paintwork.</i>			5
Monitor fuel consumption from driving computer or write down the fillings.	<i>The hot spots of fuel consumption can be recognized and avoided.</i>	<i>Possible damages are easier to find and repair on time.</i>	<i>Emissions are related to fuel consumption.</i>		5 ³⁰
Driving style					
Do not warm the engine by idling; continue driving after start immediately when possible.	<i>The fuel consumption of cold engine is 60 % more than in normal drive.</i>				10
Switch the engine off in a traffic jam and blocks.	<i>The amount of fuel saved in 30–40 seconds stop is greater than the amount needed for re-start.</i>				6

²⁹ For example, the first instruction: 'Plan the driving route...' contributes to such aspects as 'Energy consumption and CO₂' 'Noise' and 'Emissions of NO_x...' but is not so relevant for the aspect 'Life Time'

³⁰ Instructions for using driving computer were common but only in 5 manuals the driver was encouraged to monitor fuel consumption.

Drive the length of a vehicle with the first gear and shift up to the next gear at 2000 revs. / Switch to higher gear when possible.					5
Do not accelerate and brake aggressively and do not use high revs and kick down position.		<i>Aggressive driving style weakens brakes and wheels.</i>			10 ³¹
Drive at stable and moderate speed. / Recognize that higher speed consumes more fuel.	<i>Aggressive accelerations and driving over 80 km/h consume fuel excessively. Speeding up from 110 km/h to 130 km/h increases fuel consumption 25%.</i>				6
Foresee ahead.	<i>Foreseeing traffic reduces aggressive braking and acceleration.</i>				7
Allow the vehicle to roll to a stop if possible. / Change to a lower gear in good time when driving downhill, in order to make use of the engine braking effect.	<i>Vehicles with the latest technology do not use fuel in engine braking.</i>				9
Use the gear that best suits the conditions.	<i>Usually the higher the gear the less is fuel consumption.</i>				9
Do not drive at top speed.	<i>By driving at 2/3 of the gear's top speed, the consumption reduces by 50 %..</i>				6
Pre-heating the engine					
Use an engine heater when the outside temperature is below +5°, but do not use it more than max. 1,5 h.	<i>Over heating consumes electricity unnecessarily. Recommendations: ½ h when +5° ... -5° 1 h when -5° ... -10° 2 h when below -10°</i>	<i>Beneficial to the engine and battery but over heating weakens the features of cooler fluids.</i>	<i>Engine heater reduces the emissions from cold starting.</i>		1
Do not use an inside space heater at full efficiency.	<i>Inside air heater consumes 700-1800 W energy and is one of the households' most energy consumable appliances.</i>				-
Switch off small electricity devices (indoor lamps, heaters, emergency lights) when not necessary to use. / Do not leave the lights on while the car is not running.	<i>Window heater consumes around 1 liter of fuel in 10 hours.</i>	<i>Small devices discharge the battery in few days if they are left switched on.</i>			8
Air resistance					
Do not carry extra load.	<i>Extra load increases air resistance and fuel consumption around 1 liter per 100 km..</i>				8

³¹ In addition, 2 manuals included this advice in the instructions for 'drive-in'.

Remove car rack and ski rack when not needed.	<i>For example in the speed of 100-120 km/h, fuel consumption increases 10 %.</i>				8
Install the correct tire pressures and check them regularly.	<i>0,5 bar too low tire pressures increase the fuel consumption by 5 %.</i>	<i>Too low tire pressures shorten the life time of wheels by 1/5.</i>			12
Check the tire pressures when tires are cold, and / or do not lower the pressure from warm tires.					12
Do not use wide or flat tires.	<i>Flat tires increase fuel consumption...</i>			<i>...and noise.</i>	-
Change winter tires to the regular ones on time.	<i>Winter tires consume even 10 % more fuel than the regular ones.</i>				4
Air conditioning					
Do not use air conditioner if not necessary but switch it on once or twice a month for few minutes.	<i>Air conditioner increases fuel consumption around 0,5 – 1 l per 100 km.</i>	<i>The air conditioner must be used regularly to ensure its proper functioning.</i>			10
Remove snow and icing from the air heating system. / Keep the heating system clean.					11
Do not drive windows open	<i>Open windows increase air resistance and fuel consumption.</i>		<i>CO emission exposure may increase.</i>		2

1B) PREVENTION OF CORROSION

INSTRUCTIONS	SOME JUSTIFICATIONS OF THE INSTRUCTIONS AND RELEVANCE TO THE ENVIRONMENTAL ASPECTS BELOW		N =
	<i>Life Time</i>	<i>Chemicals</i>	
Corrosion prevention			
Wash bird droppings, insects, tree resin, road and industrial grime, spots and road salt immediately.	<i>These are threatening factors to the bodywork.</i>	Chemicals from washing should not be released to the environment.	12 ³²
Depending on the driving conditions, wash the car frequently.	<i>If driven in the coastal area or salty roads, washing should be done at least monthly.</i>		8
The underbody should be washed at least after the winter time.	<i>Road salt has a strong corrosive effect.</i>		8
Wax the car twice a year in addition to the regular wash.	<i>Paintwork should be waxed at the latest when water on the clean paint does not form small drops and roll off.</i>		9
Avoid direct sunlight.			8
Wipe fuel spillages and other solvents from paintwork immediately.	<i>The paint could be damaged.</i>		8
If you use a blanket, take care that both the blanket and the vehicle are clean and the blanket fits the car well.			1
Repair the scratches from rocks accordingly (+ instructions).	<i>The area where rocks hit the most is 50 m at 90 km/h speed. Scratches serve as a ground for corrosion.</i>		10
Use professional rust proofing, or ask manufacturer for advice.			8
Check the underbody regularly twice a year.			8
Insert mud flaps.			1
Avoid too hard water pressure when washing.	<i>When washed with high pressure the wash should not be closer than 30 cm.</i>		7
Keep the inside of the vehicle and garage dry and ventilated.			1

³² At least bird droppings and insects were mentioned in every manual as threatening factors to the bodywork.

1C) MAINTENANCE AND CARE

INSTRUCTIONS	SOME JUSTIFICATIONS OF THE INSTRUCTIONS AND RELEVANCE TO THE ENVIRONMENTAL ASPECTS BELOW					N = 12
	Energy Consumption, CO ₂	Life Time	Chemicals and Waste Water	NO _x , VOC, CO, PM _x	Noise	
Maintenance and care						
Check the oil level regularly and change it according to the manufacturer's instructions.	Depending on the driving style, oil consumption may be 1 l / 1000 km.	If the oil change is not taken care of properly, the catalytic and engine may damage.	Spills of oil and fluids are harmful to soil and water.			12
Do not use additional engine (or fuel) substances unless the manufacturer recommends.						10
Take care of the regular servicing according to the manufacturer's instructions.	Insufficient servicing may increase the fuel consumption by 10%.					12
Check the fluid levels regularly (oil, engine cooler, brake, clutch, battery, window fluids), and the ground below the vehicle.						11 ³³
Use only professional repairs and vehicle specific spare parts.						10
Do not over fill the tank.			Fuel may extrude from the tank.			9
Never drive the fuel tank completely empty.		Irregular fuel supply can cause misfiring. This allows fuel into the exhaust system, which can cause overheating and damage the catalyst.				8
Do not rest hand on the gear lever while driving.		The pressure of hand is transmitted to the selector forks in the gearbox and can cause premature wear in the long run.				5
Do not rest foot on the brake while driving.		The pressure of foot burdens the braking system.				6
Check the tires regularly, especially after hitting an edge.	Unstable tires and improperly adjusted steering angles increase the fuel consumption.					9
When changing the tires define the correct rotation.						6

³³ Oil level was encouraged to be checked in all manuals, engine cooler, brake and clutch fluids in most of the manuals, battery in 7 and window fluids in 4 manuals.

Change the tires at the same side from front to back after 10 000km						8
Wash the tires, mark, hang them up and store on one's side as dry and far from grease and light.						4
Remove oxides from the battery and keep it dry and clean.		<i>Uncharged battery freezes already in – 10° and a charged battery in –70°.</i>				3 ³⁴
If the vehicle will not start immediately, wait for few minutes.		<i>This helps the battery.</i>				7
Use caution signal carefully.						-
Car Wash						
Wash the car in a special wash bay that recycles the water.			<i>Less waste water and chemical releases.</i>			3
Do not use solvents if not necessary.		<i>Strong solvents wear the paintwork.</i>	<i>Strong solvents are hazardous chemicals.</i>			6 ³⁵
Do not wash the engine by yourself (or cleaning instructions for the engine are given).		<i>Engine space may damage if the wash is done incorrectly.</i>	<i>Oil spills and other fluids may release.</i>			6
Use eco-labeled car care products.			<i>Ecologically degradable.</i>			3
Follow the washing instructions for all surfaces. (Detailed instructions given for bodywork, textiles, plastics, windows, locks, rubber, safety belts, etc..)		<i>Do not try to remove dirt, mud or dust from the dry surface.</i>				10 ³⁶
Special conditions						
Prepare the vehicle for winter on time (+ instructions for winter use and drive).						6
Do not idle in indoor space, or drive the back box open. (Cautions about CO – emissions.)				CO exposure.		12
Follow the 'drive in' instructions carefully (+ instructions given).		<i>The proper functioning of a car is dependent on how carefully the 'drive in' has been done.</i>				10

³⁴ Many of the batteries are service free and do not need regular maintenance.

³⁵ 6 manuals recommended not to use strong solvents, and 10 manuals recommended not to use solvents for textile and other material inside.

³⁶ 10 manuals instructed the car wash generally, although there were great differences in how detailed and clearly the instructions were given.

If the vehicle is not used for several weeks or months... (instructions given), or ask special advice for lay down.		<i>There are several aspects that should be noticed when the car is laid down for a while.</i>	<i>Chemicals may release.</i>			3 ³⁷
Follow the special instructions for pulling trailer or towing (+ instructions given).	<i>Fuel consumption increases when pulling extra load.</i>	<i>Towing may damage the gears and catalyst.</i>				12

³⁷ In 5 manuals, single instructions e.g. for battery were given, but only 2 manuals included a lot of instructions for long term lay down. One of these manuals included also instructions for recovery after the lay down period. In addition, one manual encouraged to contact the manufacturer (seller) to ask instructions for lay down.

1D) DISPOSAL OF PARTS, FLUIDS AND BODYWORK

INSTRUCTIONS	SOME JUSTIFICATIONS OF THE INSTRUCTIONS AND RELEVANCE TO THE ENVIRONMENTAL ASPECTS BELOW			N = 12
	Chemicals and Waste Water	Emissions of NO _x , VOC, CO and PM _x	Solid Waste	
Never spill fluids (oil, grease, coolants, antifreezers solvents, clutch, brake, and other fluids) to the environment.				8 ³⁸
Waste oil and other fluids must be delivered to the collection of hazardous waste.	Many service stations accept hazardous chemicals.			4
Deliver also oiled cloths and filters to the hazardous waste collection.				6 ³⁹
Do not mix the hazardous fluids.				-
If the oil or other fluids spills to the ground, use a special material such as sand to adhere the spill.				-
Do not store hazardous chemicals.				1
Change oils and fluids in service station or professional repair.				2-9 ⁴⁰
Never spill chemicals down the drain or discard the packages as household waste.				2
Deliver an end-of-life battery to the hazardous waste collection.				5
Handle the battery carefully.	Exposure to acids.			4
Do not handle the batteries from small appliances as household waste but deliver them to the collection of batteries.				6
Deliver the end-of-life tires to the tire dealer (or dispose appropriately).				4
Deliver the end-of-life vehicle and parts to the car breaker.		Paints may release.		2

³⁸ 3 manuals only stated that the disposal of fluids must be done appropriately whereas 5 manuals highlighted that the fluids should not be discarded to the environment.

³⁹ 4 manuals only stated that the disposal of cloths must be done appropriately whereas 4 highlighted that the oiled cloths must be delivered to the collection of hazardous waste.

⁴⁰ Professional oil change was recommended in 9 manuals, whereas professional changing of other fluids was recommended in fewer manuals.

1E) OTHER INFORMATION AND THE WAY OF PRESENTING IT IN MANUALS

Environmental and Maintenance Information on:	N = 12
Energy consumption in different conditions, e.g. - for road, heavy traffic, combined conditions - and for different sizes of engines - and for different speeds - and for different sizes of tires - and for automatic and manual gears	8 ⁴¹ (8) (8) (1) (1) (2)
Environmental advice is listed in a table or summarized in a special chapter including: - sources of fuel consumption and actions to reduce the impact (i.e. tips for eco-driving) - corrosive and threatening factors to the bodywork and operations to prevent corrosion and damage - extreme conditions for the vehicle and instructions on how to prepare the car for these - sources of noise and actions to reduce the noise - disposal / collection points for different kinds of waste (e.g. waste oil, fluids, battery, etc.)	8 5 3 3 ⁴² -
Contribution of CO ₂ to green house effect and NO _x , and VOC to tropospheric ozone formation (smog) and the role of passenger cars in this context.	1
List of suitable engine oils (brands) and fuel qualities.	10
List of environmentally sound or eco-labeled car care products.	1
Data on materials in the vehicle, e.g. transmission material in air conditioner, paints, rust proofing chemicals etc. (and their environmental influence).	7 ⁴³
Contact information for additional environmental information (e.g. the EU Commission's web-page 'New passenger cars - information on fuel consumption and CO ₂ emissions').	1
Recyclability of the vehicle and its parts.	2
Information on how the consumer can make use of the manufacturer's take-back offer.	1
Maintenance and cleaning by users including: - regular checks listed - instructions for other operations the user is allowed to do (e.g. changing the battery)	12 ⁴⁴
Maintenance and cleaning by qualified persons including: - frequency and operations of regular servicing - a list of operations that the user should not do by himself	12 ⁴⁵
Fault diagnosis including possible faults and repair solutions.	1 ⁴⁶
Consequences of improper care or ignorance of instructions.	6 ⁴⁷
Texts and Illustrations:	N = 12
Clarifying figures and tables, e.g. relation of temperature and fuel consumption, or speed and fuel consumption	4
Colors and / or bold typeface highlighting the most important points.	11 ⁴⁸
Environmental symbols to capture the reader's attention.	4
Justifications and facts to support instructions, and encouragements to follow the instructions.	9 ⁴⁹
Quantitative data presented e.g. on how much the driver can save fuel.	4
Environmental advice is repeated in relevant passages of the text.	4

⁴¹ This information existed only in 8 *user* manuals, but it likely appears in the *service* manuals (which were not received) for the remaining 4 brands.

⁴² None of the manuals included a list of sources of noise, but 3 manuals mentioned the sources of noise in relevant passages of the text, e.g. do not accelerate aggressively – reduce fuel consumption and noise.

⁴³ 5 of the manuals included information on the transmission material of the air conditioner but 2 of the manuals included information also on other materials of the vehicle.

⁴⁴ Regular checking was advised in all manuals but only half of the manuals advised the checks as a compact and clear list, e.g. a table including daily, monthly and annual checking. In one manual the list was printed on the back cover of the manual.

⁴⁵ Although all the manuals stated the importance of regular servicing and included separate cautions about operations that the user should not carry out, only one manual included a clear list of operations that the user should not do by himself, referring to different parts of the vehicle.

⁴⁶ All the manuals included explanations of warning lamps and signals but only one manual included a list of other possible faults and damage that should be recognized.

⁴⁷ Several consequences due to improper care were mentioned in every manual whereas detailed advice existed in half of the manuals.

⁴⁸ Colours were used in 4 manuals, and bold typeface in 7 manuals.

⁴⁹ Great varieties existed in the presentation of justifications; some were more thorough than others.

Appendix 2 Environmental advice found in user manuals of refrigerator-freezers

2A) ENERGY EFFICIENT USE, DAILY PRACTICES AND DISPOSAL

INSTRUCTIONS		SOME JUSTIFICATIONS OF THE INSTRUCTIONS AND RELEVANCE TO THE ENVIRONMENTAL ASPECTS BELOW					N = 6
		Electricity Consumption	Life Time	Transm. Materials	Noi-se	End Use	
Location and space							
Locate the appliance as follows (exact free space measurements given for top, under, and sides).	Inefficient air circulation increases electricity consumption by 10-200 %.	Too tight location shortens the life time.				5	
Do not block the air circulation e.g. do not cover the ventilation socle at the bottom.		Blocked ventilation may break the power unit.				6	
Do not locate the appliance close to a source of heat (stove, oven, radiator, dish washing machine), or direct sunlight.	Increase in rounding air temperature from +25 to +32 doubles the consumption.	Warmer rounding air temperature wears the compressors.				6	
Place the device into dustless, dry, ventilated and cool place (min., max temp. advised e.g. +16..+32).	Significant electricity savings can be achieved.					6	
Adjust the legs to make the cabinet stand straight.						4	
After transferring the appliance wait for at least two hours before switching it on.	The compressor oils must stabilize.					6	
Inside temperature							
Install the inside temperature +5 for refrigerator and -18 for freezer.	Each degree colder air increases electricity consumption by 5 %.					4	
Do not keep unnecessarily cold temperature inside.						2	
Check inside temperature by placing a thermometer in a water glass in the middle of the cabinet.	It should show +5 degrees.					3	
Always check that the door is tightly closed, and do not open it unnecessarily.						2	
Gather the foodstuff and place them to the cabinet together.						-	
Let the foodstuff cool down before placing them into the cabinet.	Cooling down and covering the food reduces the need for defrost.					5	
Defrost the frozen foodstuff in the refrigerator.	Coldness decreases electricity consumption.					3	
Place the foodstuff in a way that does not block air circulation. Do not place them into the back wall.						6	

Use the freezing button only when large amounts of foodstuff are put to the freezer and switch it off when not needed anymore (if not automatic).						4
Regular checking and maintenance						
Defrost the freezer latest when the ice is 0,5 cm (if not automatic defrost).						5
Do not speed the defrosting artificially by other devices or sharp items.		<i>Sharp items may cause damage.</i>				5
Regularly control over the condensation and compressor pipes that they are on place and clean.		<i>If they are not clean or on place, this will direct the water to the floor.</i>				3
Keep the appliance and its backside clean by carefully hovering it once or twice a year, but watch out damaging the compressor.	<i>This reduces electricity consumption.</i>	<i>Dust blocks air circulation and may cause fire.</i>				6
Clean the appliance regularly. Use neutral dish washing liquid and soft cloths. Do not use stain removers. (+ other instructions for washing).						6
Check the door seal regularly and clean it with neutral dish washing liquid, or change it, if needed.	<i>Improperly functioning seal consumes electricity.</i>					3
Functioning of door seal can be checked by placing a flashlight into the cabinet. If light comes through the seal, it is not functioning properly.						-
Check the energy consumption; if the compressor whirls all the time, or the thermostat must be high to sustain the temperature... (Sources of energy consumption)	<i>...too much energy is consumed.</i>					2
Repair the energy spender as follows.. (instructions), e.g. clean the condenser, change the door seal etc.						2
Prefer professional repairs and spare parts.						6
When booking the service inform the following data (given).						6
Monitor noise level (+ normal noise level and possible reasons and solutions for extra noise given).						2
Part-time use and disposal						
When the appliance is not in use, leave the door ajar.						6
Use the energy saving button if needed.						3
Deliver the package material to the waste collection point.						5
Deliver the appliance to the correct collection point.						6
When disposing of the end-of life device, handle it carefully.			<i>Material may release.</i>			4

2B) OTHER INFORMATION AND THE WAY OF PRESENTING IT IN MANUALS

Environmental and Maintenance Information on:	N = 6
The annual electricity consumption (kWh / year).	3
Contribution of the heat transmission materials (of the specific model) to the ozone layer.	5
Freezing capacity (kg / day) and how much can be frost without using the freezing button.	6 ⁵⁰
Noise levels in different conditions.	-
That the appliance contains fluids and is made up of parts and materials which are reusable and / or recyclable and how the consumer can effect the reuse, recycling and other utilization of the materials.	4
How the consumer can make use of the manufacturer's take-back offer.	-
Effects to the environment if the appliance is used or disposed improperly.	2
Environmental information summarized or listed:	2
- sources of electricity consumption and tips for economical use of the appliance	4
- sources of noise and reasons and actions to reduce the extra noise (repeated in relevant passages of the text).	3
A check list for regular operations and checks to be done by the user... ...and a list of operations that the users should not do by themselves.	5 ⁵¹
Fault diagnosis (check list) including possible faults, repair solutions and repairperson suitable to do the fixing.	6 ⁵²
Restrictions of use.	6
Using and storing the appliance in places that are part-time in low temperature (e.g. summer house)	6
- e.g. the door must be left ajar when not in use and taking the device back in use	-
- e.g. the appliance must be at room temperature before switching on	
- e.g. see instructions for assembly and positioning etc.	
Texts and Illustrations:	N = 6
Clarifying figures and tables, e.g.:	
- of free space around the appliance	5
- on hovering the back side of the appliance and the correct place of the compressor pipes	4
- on placing the food in correct places in the cabinet	5
Colors and / or bold typeface highlighting the most important points.	3
Symbols to capture the reader's attention.	2
Active and encouraging voice	3
- e.g. follow the energy saving tips	
- e.g. by cleaning the device regularly the life time of the appliance increases	
Justifications and facts to support instructions and statements.	4
Quantitative data on energy savings.	1

⁵⁰ All manuals informed the freezing capacity (kg / day) but information on how much can be frost without using the freezing button was advised only in one manual.

⁵¹ Although the operations that the user should do regularly were mentioned in the manuals, e.g. hovering the condenser, these regular tasks were scattered among other instructions and may not be noticed as if they were listed in a separate chapter.

⁵² A check list for possible faults and repair solutions was found in every manual. However, the amount of information in this list varied a lot.

Appendix 3 Environmental advice in instructions for use of Sofa

I Care instructions for upholstery and frame
<ul style="list-style-type: none"> washing declaration symbols explained by words, or a reference to the declaration in the textile possible additional texts to washing declaration and instructions about drying (spin / tumble / indoor / outdoor drying), stretching etc. washing instructions for <ul style="list-style-type: none"> frame (damp, wet or dry wiping, etc.) padding upholstery material(s) instructions about regular care and maintenance cleaning, such as wiping, airing, vacuum-cleaning, removal of stains, brushing instructions (including frequency) for possible protective care treatments, such as waxing information and recommendations about cleaning agents, and cautions of cleaning agents that should not be used cautions about items not to be used (such as sharp items, brush) link to the additional information for textile and frame care (such as the www-address of the manufacturer, or other database) textile sample delivered with the sofa for cleaning or coloring test
II Durability in use
<ul style="list-style-type: none"> notice about durability of 'normal use' additional notices about actions not to be done, such as sitting on the armrests, stepping or jumping on the sofa, etc. advice to place coverings on the bottom of legs between the floor and the sofa (coverings accompanying the instructions) notices where the sofa should not be placed and why; e.g. keep the sofa away from direct sunlight or plant lamps, as well as humidity and heat, since they may cause the upholstery to fade other instructions, if needed, such as advice about lifting the sofa, etc. protective actions against wearing and tearing, e.g. regularly use both sides of cushions to make them last longer
III Reusability, recyclability and disposal
<ul style="list-style-type: none"> exact data about materials included in the sofa e.g. <ul style="list-style-type: none"> frame material padding and upholstery materials chemicals used such as paints, varnish, creosote or other treatment chemicals formula of the upholstery for recovering the sofa tips and instructions for reuse and modernizing of the furniture instructions for recycling of materials (for example; wood – recyclable) markings of recyclable items in the sofa markings for correct disposal of the packing material

Appendix 4 User information in textiles produced by the manufacturer

I Washing Declaration
<ul style="list-style-type: none"> • 5 symbols including: <ul style="list-style-type: none"> - water wash + temperature <ul style="list-style-type: none"> a) machine wash + temperature b) hand wash + temperature c) water wash forbidden - bleaching (allowed or not allowed) - ironing (temperature) - chemical wash (allowed or not allowed) - tumble drying (allowed or not allowed) • additional texts, if important for the garment, e.g.: <ul style="list-style-type: none"> - wash with like colors - wash inside out - fabric softener not allowed - shrinkage / stretch (%) - recommendations and restrictions for detergent quality - other recommendations or restrictions (for example, flat drying, or do not soak) - some of the symbols explained or highlighted by words, e.g. cannot be washed below the mentioned temperature - contact information where to find more care instructions
II Additional information on:
<ul style="list-style-type: none"> • the use conditions of the garment (such as water resistance etc.) • recommendations of the laundry detergent • detailed washing instructions on how to get the best washing result (e.g. wash inside out, hand wash prohibited, close zips, buttons, remove certain parts, etc.) • removal of stains and use of stain remover • detailed instructions on drying the garment (e.g. flat, hanging, outdoor, indoor, tumble, etc) • washing declaration symbols explained by words • storing the garment while not in use (e.g. silk in a plastic) • recommended washing frequency • recommended daily practices, such as airing, brushing etc. (e.g. air the garment instead of washing too frequently) • repairing and modernizing tips and instructions • contact information on additional information
III Presenting the information:
<ul style="list-style-type: none"> • Information could be presented in <ul style="list-style-type: none"> - washing declaration - a hanging note in the garment - separate paper sheet in the package of the garment - separate paper sheet delivered by the seller when buying the garment

Appendix 5 Environmental advice found in packages and other environmental information for the use of cleaning chemicals

5A) USE AND DISPOSAL OF LAUNDRY DETERGENTS AND ALL PURPOSE CLEANERS

ENVIRONMENTALLY SOUND USE OF LAUNDRY DETERGENTS	N = 25	ENVIRONMENTALLY SOUND USE OF ALL PURPOSE CLEANERS	N = 15
Suitability of cleaning agent			
Suitability and / or non-suitability of cleaner to different materials informed, e.g. do not use for silk, wool, etc.	17	Suitability and / or non-suitability of cleaner to different materials, e.g. do not use for lacquered wooden surfaces etc.	14
Informed that detergents containing bleaches may in the long run cause colors to fade and thus the color-label of the brand is preferred for colored textiles.	12 (N = 19)		
Dosing instructions			
Consumers are encouraged to follow the dosing instructions.	9	Consumers are encouraged to follow the dosing instructions.	4
Dosing amount is given (in ml or in number of capsules).	25	Dosing amount is given (in ml or in numbers of caps), e.g. 5 caps per 10 liters.	11
Dosing instruction is given for at least two of the common sizes of washing machines, i.e. 5-7 kg and 3-5 kg.	20	Dosing instructions are illustrated by figures or clear tables.	11
Dosing instruction is given for the three different water hardness.	20	Dosing instruction is given for different water hardness.	1
The most common water hardness in the country is given, or users are encouraged to contact the local waterworks to get the data.	8		
Dosing information for normal and for filthy (pre-washable) laundry is given.	14	Dosing information for normal and for heavily soiled surfaces is given either by giving exact numbers of dosing, or by stating that for heavily soiled surfaces the dosing should be increased.	10
Notification that if the laundry is heavily soiled, the dosing could be worth added.	6		
Notification about pre-wash and soaking, e.g. pre-wash should only be used if the laundry is heavily soiled, or 'do not soak or pre-wash'.	7	Dosing information is given exactly, i.e. without dosage intervals.	14
The most efficient means of using the detergent is advised, e.g. use the dosing ball, dose directly on the spot, etc.	13	The most efficient means of using the cleaner is advised, e.g. use directly on the spot, etc.	13
Users are advised to keep the detergent in its original package.	-	Users are advised to keep the cleaner in its original package.	-
General washing and cleaning advice			
Users are reminded to follow the washing declaration in the textile.	13	Users are reminded to prepare the cleaning solution only the needed amount.	-
Users are encouraged to sort the laundry according to color, dirtiness, material and washing temperature.	11		
Wash-Right symbols are presented.	18		
Wash-Right symbols are presented and the symbols explained ('avoid underfilling', 'dose according to dirtiness and water hardness', 'always use the recommended temperature' and 'reduce packaging waste').	7		
'Wash full loads' is stated by words.	2		
Users are reminded: 'Do not overdose'.	1	Users are reminded: 'Do not overdose'.	1
The contact information of the manufacturer or contact information for additional information is given.	25	The contact information of the producer or contact information for additional environmental information is given.	13
Refilling and disposal of package			
Refilling packages are available.	-	Refilling packages are available.	1
Clear verbal instructions on how to dispose or recycle the package are given, e.g. suitable for composting, collection of cartoon, etc.	3	Clear verbal instructions on how to dispose or recycle the package are given.	4

5B) OTHER INFORMATION ON THE ENVIRONMENTALLY SOUND USE OF LAUNDRY DETERGENTS

(not checked from the samples)

Environmental information on environmentally sound use of cleaning agents given generally
<ul style="list-style-type: none">• Information on the causes of overdosing, e.g. overdosing may damage the textile or the surface and cause allergic reactions and make the rinsing difficult.• The instructions should be checked regularly since the dosing advice may change due to the improvements in the product.• A dosing cup of correct size (e.g. 50 ml for laundry detergents) should be used to avoid overdosing.• Removal of stains could be used instead of frequent washing.• Information on water hardness locally.• The impact of correct dosing to the saving in the amount of product used and money saved.• The use of cleaning products in sparsely populated areas, summer cottages and other places without common sewage treatment system. Especially, if the product contains environmentally harmful substances such as phosphate, this instruction should be stated also in the package.• General instructions for washing (e.g. use the lowest allowed temperature etc.).• General instructions for cleaning, e.g. favoring regular maintenance cleaning instead of thorough cleaning rarely, or doing more mechanical work will require less cleaner etc.• Prefer reusable and recyclable packages.

Appendix 6 Environmental information on the use of paper products

I INSTRUCTIONS FOR RECYCLING OF PAPER PRODUCTS

A) Printing Paper:

- Advice in workplaces:
 - ☐ unbound the rubber bands (studs and paper clips are not needed to separate)
 - ☐ put the cardboard to the waste for energy recovery (not to the paper waste)
 - ☐ do not put colored paper among white recovered paper
 - ☐ replace colored paper with margin colored paper
 - ☐ recycle also archive papers
 - ☐ recycle confidential papers through companies specialized for this purpose
 - ☐ separate white printing paper from newspapers and advertisements; handle it as white paper waste
- Advice in the package of printing paper:
 - ☐ 'paper recyclable'
 - ☐ 'package suitable for...' e.g. collection of cartoon / waste for energy recovery

B) Envelope:

- Advice in the product:
 - ☐ marked, if not recyclable
- Advice given generally:
 - ☐ put envelopes to the cardboard waste or to the collection of waste for energy recovery
 - ☐ plastics, glue and other dirtiness should be removed before throwing envelopes into recovered paper
 - ☐ in households, different colored envelopes go to the household recovered paper

C) Newspaper:

- Advice in newspapers, or given generally or by recycling companies:
 - ☐ in households, deliver papers to the household waste paper bin
 - ☐ do not put other waste, such as board, plastics or wet paper among newspapers, since they may pollute the total lot
 - ☐ do not bind the sheaf of the paper; the rope does not scatter in the paper handling
- Advice in workplaces:
 - ☐ recycle useless papers among newspaper and magazines

II INSTRUCTIONS FOR REUSE OF PAPER PRODUCTS
<p>A) Printing Paper:</p> <ul style="list-style-type: none"> Advice in working places: <ul style="list-style-type: none"> ☐ use a blank side of a previously used sheet ☐ give one side used papers to the day-care centers etc. for drawing paper ☐ deliver used folders for reuse <p>B) Envelope:</p> <ul style="list-style-type: none"> Advice in working places or given generally: <ul style="list-style-type: none"> ☐ reuse envelopes by placing a label over the old address <p>C) Newspaper:</p> <ul style="list-style-type: none"> Advice given generally: <ul style="list-style-type: none"> ☐ reuse newspapers for packaging ☐ deliver old newspapers and magazines for neighbors, schools, hospitals etc.
III INSTRUCTIONS FOR REDUCE OF PAPER PRODUCTS
<p>A) Printing Paper:</p> <ul style="list-style-type: none"> Advice in work places: <ul style="list-style-type: none"> ☐ set up printers and copying machines to print and copy documents two-sided ☐ do not use fax cover sheets ☐ reduce report size ☐ preview documents and print or copy only needed pages ☐ circulate one paper around instead of copying masses ☐ use bulletin board or e-mail for informing <p>B) Envelope:</p> <ul style="list-style-type: none"> Advice in work places: <ul style="list-style-type: none"> ☐ reuse envelopes in internal mail ☐ use electronic mail and voice mail <p>C) Newspaper:</p> <ul style="list-style-type: none"> Advice given generally: <ul style="list-style-type: none"> ☐ use the public libraries for reading magazines and newspapers ☐ circulate a newspaper and magazines for reading