

FUTURE-ORIENTED PRODUCTS AND SERVICES

NEW APPROACHES TO INNOVATIVE AND
ENVIRONMENTALLY SOUND PRODUCT DESIGN



NEW ROADS TO AN ENVIRONMENTALLY ACCEPTABLE PRODUCT DEVELOPMENT

The objective of sustainable development should be to maintain our present state of prosperity with less material input and to dramatically increase the productivity of resources. Smart products and services of tomorrow will be dematerialized throughout their whole life cycle.

(Prof. Dr. Friedrich Schmidt-Bleek)

A future-oriented economy should have the goal to supply products and services with the least possible input of raw materials and energy. Sustainable development requires an enormous increase in energy efficiency and resources productivity. More efficient production processes saving on raw materials as well as on energy, thus reducing damage to the environment and also production costs; environmentally acceptable, durable products, which cause as little ecological damage as possible taking into account their whole life cycle; product-specific services and an appropriate user conduct, often within the framework of new organizational structures. The Austrian Federal Ministry of Science and Transport initiates incentives and programs with the emphasis on research and technology, and which concentrate on economy-related projects and implementation strategies with a view to sustainability. The goal is to elaborate a scientific foundation but also to support practical and implementation-oriented projects. The PREPARE initiative, which develops strategies for preventive environmental protection and their implementation in enterprises and the biennial Austrian ECODESIGN-contest (a contest awarding prizes to future-oriented products and solutions) have already given impetus to this development. Recent studies in this field concentrate, in particular, on the implementation of scientific findings in the product planning process and on the development of evaluation criteria for an "environmentally acceptable" product design.

■ The fundamental principles of this approach can be found in the recent study *"Anforderungen an nachhaltige Technologien"* (Requirements for Sustainable Technologies) carried out by the Austrian Institute for Sustainable Development; the study constitutes a concrete contribution to a new technology focus, which concentrates on "Technologies for Sustainability". The study was based on five individual expert opinions which analyze different specific approaches to the development of sustainable technologies. They deal with the effects of sustainable development on the prevailing conception of technology and on the consequences for technology policies, analyze relevant system-theoretical aspects, and define concrete requirements as to the contents of sustainable technologies.

The study also describes approaches and prerequisites for the implementation of these principles in enterprises and highlights key-areas for future promotion of innovative technologies.

Within the scope of the congress / fair *"FAKTOR 4+ - Der Weg in die Zukunft"*, (Klagenfurt, 1998) (FACTOR 4+ - Roads to the Future) a study entitled *"Wissenschaftliche Grundlagen für eine Ressourcenoffensive"* (DI Manstein, Univ. Doz. Dr. Kanatschnig) was carried out. The objective of this study was to build a bridge between theory and practice and to launch an "offen-

FAKTOR 4+

The formula FACTOR 4+ means that man would have to make a four to ten times more efficient use of raw materials in order to secure present levels of prosperity and, at the same time maintain a healthy environment. The concept focuses on the question of how to provide products and services with a minimum input of material and energy. A reduction of the energy and material input by the factor 4+ causes an enterprise to spend less on energy and raw materials; at the same time, there is a reduction of waste, emissions, and waste water, which brings a further reduction of costs.



*Multi-Generation Children's Shoe / GOLDEN GATE
Award winner ECODESIGN-contest 1996
Children's shoe with exchangeable foot bed for different foot shapes*

sive for the efficient use of resources" in Austria. It was to motivate enterprises to offer - not least for cost reasons - "eco-smart" products, technologies, and services, which use up less raw material and energy, thus showing a higher resource productivity.

A study conducted by GrAT (Gruppe für angepaßte Technologie, author: Lothar Rehse) deals with the possibilities and perspectives of environmentally conscious product design. The research project *"Development of Evaluation Fields for Environmentally Conscious Product Design"* gives a systematic survey of different strategies and methods and develops, by an analysis of existing approaches, a model specially adapted to ECODESIGN-measures. The results of this work are documented below.

DEVELOPMENT OF EVALUATION FIELDS FOR ECODESIGN

Product design is a process involving technological and organizational aspects aiming at the modification of existing products and at the creation of new products in the form of goods or services.

■ The "evaluation matrix" developed for ECODESIGN within the scope of this work is to structurize the fields of action aiming at an environmentally conscious product development and to develop models and strategies for product design. The aim of this work is not the evaluation of singular environment-oriented methods and approaches but to point out different perspectives and possibilities for the product designer.

In the process of product innovation, we can distinguish three major fields of action, in which measures for an environmentally acceptable design can be taken:

1. Product improvement
 - Product optimization
 - Optimization of the production process
2. Alternative products
 - Optimization of function
 - Optimization of service

3. Strategic alternatives
 - Optimization of use
 - Regional Optimization of Systems

In addition, the fields of action are different as to the distribution of the fields of competence of the relevant actors. For each field of action, two principal modes of action aiming at a future-oriented product design can be defined:

The strategy of **production optimization** analyzes the causes of unwanted emissions and waste and of excessive input of resources, respectively, and aims at avoiding these adverse effects at source.

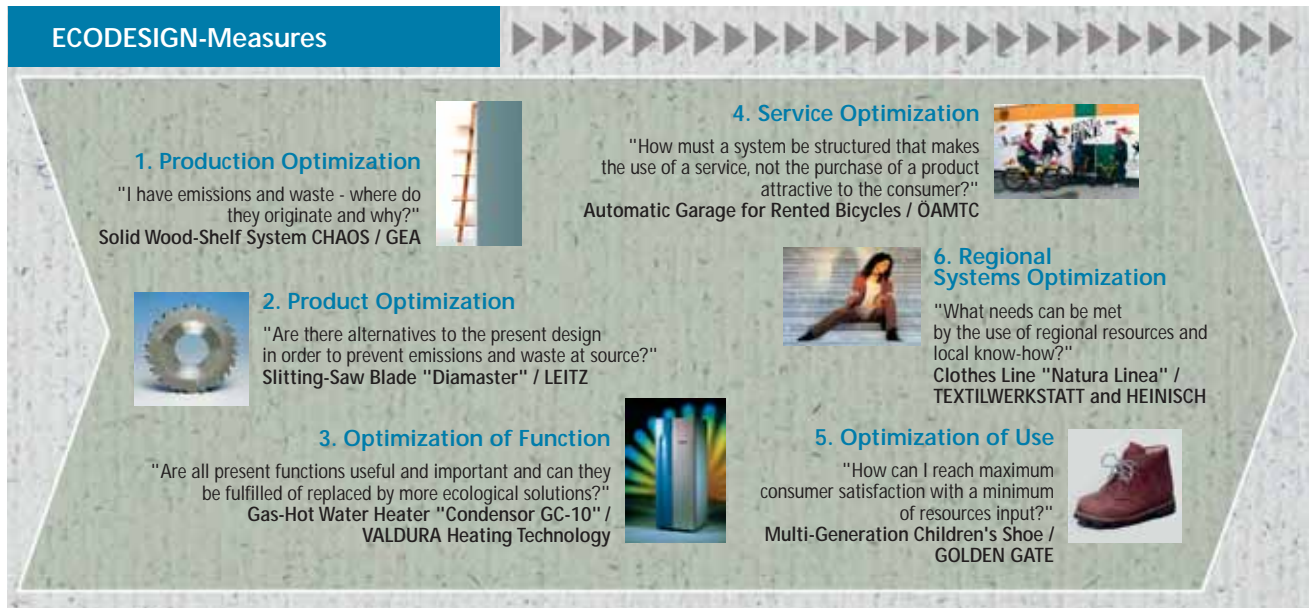
Product optimization tries to prevent waste and emissions throughout the whole life cycle of a product and looks for possible alternatives in design in order to avoid adverse effects from the beginning.

In redesigning a product or service or in developing alternative products, future-oriented optimization refers to an improvement of the offered product always bearing in mind the service really asked for.

As to the **optimization of function**, existing functions of a product are analyzed and, if possible, replaced by ecologically more acceptable solutions. The strategies of **service optimization** analyze the service of the product as a whole in order to develop leasing, renting, and service concepts which safeguard a more intensive or prolonged use of the product. The objective of both of these measures is to replace a maximum of hardware (high input of material) by software (services).

Strategic alternatives put the lever to consumption and to consumers' use of products and services. In this field intelligent concepts involving the consu-

ECODESIGN - Matrix of Measures							
Increase of Resources Efficiency	Systems Solutions	Zero-Options					
		Prevention		Externalization	Selling of Results instead of goods	Organized Customized Manufacture	Regional Service Centers
	Minimization of Material Input per Service-Unit	Service Improvement		Multifunctional Goods	Sale of Services Instead of Goods	Joint Use/Sharing	
		Reduction of Material Input	Substitution of Raw- and Auxiliary Materials	Dematerialization (Software instead of Hardware)			
	Optimization of Product Life Cycle	Longer Life Cycles		Long-Life Goods	Upgrading	Reuse	Help for Self-Help
		Closed Production Cycles	Production Waste Recycling	Repairability	Recycling of Components	Remarketing of Goods (Re-use of waste)	Non-fashionable Products
			Recycling				
		Production Optimization	Product Optimization	Functional Optimization	Service Optimization	Optimization of Use	Regional Systems Optimization
		Product Improvement		Alternative Products		Strategic Alternatives	
Fields of Action for Enterprise Strategies							



Source: Lothar Rehse, 1996

mers or local communities offer interesting opportunities. The principal question of the **optimization of use** is: "How to reach a high degree of consumer satisfaction with a minimum of resources input." **Regional systems optimization** deals with the question what needs can be met by the use of regional resources and local know-how. The goal of strategic alternatives consists in the creation of rather small and easy to handle material cycles and structures of responsibility.

Examples for prize-winning products and services of the 1994 and 1995 ECODESIGN contests show innovative qualities meeting one or several prerequisites of the models presented above. They might serve as an illustration of the systematic matrix.

Solid Wood-Shelf System CHAOS / GEA
 minimal material input, stability, durability

Slitting-Saw Blade "Diamaster" / LEITZ
 Combining extreme durability with a reduction of noise peak levels

Gas-Hot Water Heater "Condensor GC-10" / VALDURA Heating Technology
 System optimization, warming of heating water by waste water

Automatic Garage for Rented Bicycles / ÖAMTC
 Optimal service, intensive use, financially competitive

Multi-Generation Children's Shoe / GOLDEN GATE

Optimization of product and use, durability, adaptability

Clothes Line "Natura Linea" / TEXTILWERKSTATT and HEINISCH

Product made of domestic, renewable raw materials, comprehensive ecological system

In addition to the presentation of the different fields of action and models the study also tries to structurize concrete strategies for the maximization of resources efficiency. For this purpose the proposals made by Stahel and Schmidt-Bleek/Tischner (see above) served as a starting point. Strategies can be assigned to three different groups:

- Optimization of product life
 Saving on resources by measures extending the life cycle of a product or through closed cycles).
- Minimization of material input per service unit
 Increase of resources efficiency by reducing material input and/or improvement of the use intensity of processes, products, and services.
- System solutions
 Optimization of all parts of the system either by prevention or by zero-options.

A systematic compilation of the different fields of action and strategies results in the ECODESIGN matrix of measures, which helps to categorize the strategies implemented in the development of a product. It is important to note that there is no hierarchical order within the matrix and that it will grow and develop with the number of examples analyzed. This form of presentation does not require or contain any value statement, each strategy has to be considered equal in the sense of ECODESIGN. The evaluation scheme has to be seen as a dynamic instrument for the enhancement of awareness and communication: There is no product or service that is ecologically perfect in such a way that it could not be improved.

The matrix is to support the development of products and services by emphasizing those options for each development, which might constitute the next steps to a future-oriented product design in the sense of the ECODESIGN concept. It is to demonstrate the possibilities the actors participating in the development process have in their respective fields of action.

ECODESIGN - STRATEGIES AND APPROACHES

People who simply identify ecological products with wood, cork, or wool fail to see the whole picture. Ecology cannot be reduced to the choice of materials but also includes durability, function, and practicability. In order to implement these objectives the environmentally conscious designer uses high-tech as well as novel materials and smart design. Of course, this also affects the optical appearance: These products have a modular structure so they can be repaired and their surfaces can endure traces of wear and tear.

Günter Horntrich, ECODESIGN-contest brochure 1996

■ First of all, there is the question of how the actors participating in the product development process may perceive the environmental impact of their products. The results of research in the fields "**Future-oriented Development**", "Preventive Environmental Protection" (in particular the PREPARE-initiative), and approaches used in design science formed the basis for the study "Entwicklung von Bewertungsfeldern für eine umweltbewußte Produktgestaltung" (Development of Evaluation Fields for Environmentally Conscious Product Design).

The study gives a systematic outline of the most important models and procedures for the determination of the environmental acceptability of products. Thus, the study offers the possibility to present an overview of different models such as balance of ecological impact, product line analysis, MIPS-concept, eco-labeling, and legislation concerning test data, the assessment of the necessary input and the principal objective of the product in question. The MIPS-rating (Material Input per Service Unit / Prof. Schmidt-Bleek / cf. FORSCHUNGSFORUM 2/95) for the first time takes into account the concept of use in the discussion on the ecological quality of a product/service, and by its simple basic structure (Rucksack-addition of the entire consumption of used masses) offers comparable data for product development in practice. However, in addition to the measurability and the evaluation of the quality of a product, this study concentrates on the development process itself and the participating actors. Here we can differentiate between various different

basic approaches to an environmentally conscious product design:

- Product-oriented strategies concentrate on the analysis of the original product and its environmental impact and deduce criteria and recommendations for the product designer from this analysis.
- Process-oriented strategies aim at the optimization of the development process with a view to a minimization of the potential environmental impact of the product.
- Actor-oriented strategies start out from the sphere of action of the individual actor and try to take into account the environmental impact of products and production processes.
- Use-oriented strategies try to create products and services in compliance with the principle of "sustainable development" and to elaborate adequate guidelines for their development.

In the field of use-oriented strategies, we can differentiate between two principal approaches. On the one hand, there are the "LPU-strategies" developed by the Swiss Institute for Product Lifetime Research / Stahel, which propose three measures in order to reduce the consumption of resources: long term use, extension of product life (by maintenance, repair, etc.), and a more efficient use of the product (shared or joint use and extended individual use). These strategies of longer or more intensive use seem particularly suitable to attain factor 10 as far as

the reduction of the input of resources is concerned.

The second approach consists in the MIPS concept (Schmidt-Bleek, Tischner) mentioned above, which also starts from the intended use (service) for which it tries to minimize the input of resources.

Both these strategies served as a basis for the ECODESIGN matrix of measures as proposed in the study "Development of Evaluation Fields for Environmentally Conscious Product Design". The study also tries to establish a combination of the use-oriented and the process-oriented approaches.

Future-oriented Development is an open process involving all actors of society and based on an ethic requirement: the needs of the present generation have to be satisfied without impairing the possibilities of future generations to shape their own environment to satisfy their needs. This requirement presupposes technological and social innovations that considerably reduce present environmental hazards. This is just to trace out the direction of a dynamic development.

(Lothar Rehse)

AUSTRIAN ECODESIGN INFORMATION KNOT



■ The ECODESIGN-Information knot was initiated by the Federal Ministry of Science and Transport and the Vienna University of Technology and is to promote the exchange of information concerning ecologically conscious product design between scientists, product designers and interested laymen. It offers a survey of national and international activities in the fields of science, economy, and politics. Moreover, the information knot is to establish a network among practical and theoretical workers in Austria in order to safeguard the continual exchange of information in the field.

The Austrian ECODESIGN-information knot organizes events and workshops in order to promote the direct exchange of experience between researchers and enterprises and to make findings of scientific research available for product designers. In addition, it offers comprehensive information via WWW-pages and a permanent mailing list in the internet.

The infoknot pages give access to all important ECODESIGN-addresses, recent publications documenting the state of research, and offers concrete advice for practical work.

The mailing list constitutes the electronic discussion forum of the infoknot, as it were. It is to promote the exchange of information and functions as a platform for the input of new projects and for the distribution of incoming e-mail, which will be distributed to all participants. Different from a newsgroup, the user first has to log in if he or she wants to participate in the discussion.

F I G U R E S / D A T A / F A C T S

PROJECT SPONSORS

The study "*Entwicklung von Bewertungsfeldern für eine umweltbewußte Produktgestaltung*" was sponsored by the Austrian Federal Ministry of Science and Transport and by the Austrian Federal Ministry of Environment, Youth, and Family.

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The study "*Anforderungen für nachhaltige Technologien*" by the Austrian Institute for Sustainable Development was commissioned by the Federal Ministry of Science and Transport.

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The study "*Wissenschaftliche Grundlagen für eine Ressourceneffizienzoffensive*" (intermediate report) was also commissioned by the Ministry of Science and Transport.

Authors: DI Christoph Manstein
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PUBLICATIONS

"Entwicklung von Bewertungsfeldern für eine umweltbewußte Produktgestaltung"

Lothar Rehse, GrAT, Gruppe Angepaßte Technologie, Wien, 1996, published by the Ministry of Science and Transport in the series "*Berichte aus Energie- und Umweltforschung*", available at:
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FORSCHUNGSFORUM provides information on selected projects within a BMWV-program focusing on "Future-oriented Energy and Environment Technologies". Published by the Federal Ministry of Science and Transport, Department of Public Relations; Director: Dr. W. Fingernagel; A-1014 Vienna, Minoritenplatz 5. Coordination: Department of Energy and Environment Technologies; Director: Dipl.Ing. M. Paula. Photos and graphics: Lothar Rehse, ECODESIGN-Wettbewerbsbroschüre 1994 and 1996. Editors: Projektfabrik, A-1190 Vienna, Nedergasse 23. Layout: Grafik Design Wolfgang Bledl. Printed by AV-Druck, A-1140 Vienna, Sturzgasse 1A.

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Projektfabrik, A-1190 Vienna, Nedergasse 23. **FORSCHUNGSFORUM** in the Internet: <http://www.bmwv.gv.at/forschungsforum>