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### DESIGN GUIDELINES FOR RENEWABLE ENERGY TECHNOLOGIES IN MOBILE PRODUCTS

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The amount of (consumer) products that consume electricity is still increasing rapidly. Emerging technologies in the field of renewable energy, such as small fuel cells, flexible photo-voltaic solar cells and human power are promising new solutions for sustainable energy sources. As renewable energy sources develop and become smaller and more flexible, possibilities of integrating them into the product design have emerged. However, until recently, renewable energy technologies have been more or less „pasted” upon the products instead of being integrated into the design of the product. The newly developed PowerQuest tool supports designers in selecting and integrating renewable energy technologies into product designs.

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### AVOIDANCE OF DESIGN ERRORS IN ECO-INNOVATION WITH RECYCLED MATERIALS

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The interest in applying recycled materials to the production of boards for furniture and panelling has arisen in response to the social awareness of environmental degradation. In the early stages of product design, the designer is often required to make experienced judgements when information is lacking. In the case of a new material, due to the lack of experience, designers need assistance to make well-founded judgements. The paper explores the needs of furniture designers when a new material is introduced by means of studying strategies for design errors avoidance in the furniture industry, and the hazards which are avoided by means of having knowledge regarding material characteristics early in the design phase.

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### REFILLABLE PACKAGING SYSTEMS: DESIGN CONSIDERATIONS

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The overall aim of the research project reported on in this paper is to investigate the feasibility of developing a refillable packaging system for a mainstream product in the personal care market, which fulfils customer needs whilst attaining greater eco-efficiencies. By using the concept of product service systems the project aims to take a more radical approach to the design of refillable packaging systems and unlock the potential for greater sustainability improvements. This paper outlines a range of different types of refillable packaging systems and reflects on the different design considerations raised by these approaches in terms of the social, technological and economic related impacts.

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### ECODESIGN DECISION BOXES – A SYSTEMATIC TOOL FOR INTEGRATING ENVIRONMENTAL CONSIDERATIONS INTO PRODUCT DEVELOPMENT

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The Ecodesign Decision Boxes allow the implementation of environmental considerations in technical product designs and in the decisive early stages of the product development process. This systematic tool allows optimizing the entire product as well as tracking and controlling the influence on environmental aspects of a product along its life cycle phases. An overall evaluation of the environmental performance of the product design as well as a detailed view on the performance of each component, part and of each material used in the components should be assured. The Ecodesign Decision Boxes were developed to give special attention to the environmental aspect of the product development process.

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### MASS CUSTOMIZATION ISSUES FOR ENVIRONMENTALLY CONSCIOUS DESIGN

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The paper pulls a trigger of discussing Mass Customization (MC) in Ecodesign. MC is a widespread concept to increase differentiation levels of products depending on customers' needs with reducing production costs. The problem of strategy's absence in Ecodesign is addressed. Then, how MC brings benefits to an Ecodesign strategy is investigated. First, understanding customers is crucial. Second, manufacturers should distinguish between needs and wants as many environmental properties at present are a must according to regulations. Third, possessed should be four perspectives; system, value, function, and component. This approach in a broader view implies that a new design paradigm incorporating the marketing discipline may be needed.

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### ENVIRONMENTAL SIMULATION SYSTEM FOR ENVIRONMENTALLY CONSCIOUS PRODUCT DESIGN

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The product designers are demanded to harmonize the technological, the economical, the social, and the environmental domain of the product. In the early stage of product design, in order to create and verify the new idea of the product, it is necessary for product designer to easily and quickly get the overview and the insight of the influences of designing product in the environment. We propose the concept and the implementation method of new environmental simulation system based on the interaction of the subjects in the environment. The env. sim. system consists of 7 systems (subject, object, energy, human resource, economic, information, and nature system). The changed subject changes the flow of the object, energy, human resource, money, information, and natural object.

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### INTEGRATING LIFE CYCLE COSTING ANALYSIS INTO THE DECISION MAKING PROCESS IN NEW PRODUCT DEVELOPMENT

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The trend towards sustainable development is driving companies to adopt a broader life cycle perspective in product development. Within this context Life Cycle Cost Analysis models can be a decisive decision support tool. In the present paper an innovative approach to combine a stochastic LCC model and a decision support tool to assist in the optimisation of the design process is described. The model is combined with a probabilistic LCC model, in order to enable the product development team to establish and maintain a Logbook or Register of the design decisions taken during the whole process development. The work being reports preliminary findings. The full managerial implications of the model being developed are still being investigated.

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### ECO-DESIGN IN PRACTICE - CASE STUDY WITH COMPUTER MOUSE

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1427

Eco-design has been a widely discussed issue in the past few years. The reason for this is not only the ongoing changes in legal frameworks (regarding the environmental aspects of consumer products). But there is also a growing environmental consciousness of the customer. This forces producers to seriously reflect on this issue. This article introduce a simple and practical methodology to product developers. The advantage of this approach is its potential to implement a complex product analysis within a relatively short period of time and to subsequently facilitate effective product improvements.

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### CHARACTERISTICS OF STRATEGIES IN PRODUCT/SERVICE-SYSTEM DEVELOPMENT

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The underlying principle in Product/Service-Systems (PSS) strategy is to shift from business based on the value of the transfer of product ownership and responsibility, to business based on the value of utility of the product and services. This paper identifies characteristics of various strategies that may be applied in PSS development. PSS concepts created in projects by 3rd year Design & Innovation students at the Technical University of Denmark (DTU) working with product-life oriented design approaches were reviewed, and the strategies developed were analysed. This identification and mapping of PSS strategy types gives us the opportunity to develop methods and approaches to PSS development, more tailored to specific business strategies.

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### SUSTAINABLE DESIGN IN ARCHITECTURE

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The understanding of the 20th century architecture, has a big responsibility in achieving current unsustainable result of the environment. We may think of cars and factories as the most obvious enemies of the environment, but buildings consume more than half the energy used worldwide. The aim of this presentation is to obtain a general exploration of one of the most complex and problematic issues facing the humanity over the last and current centuries – that is, how to construct a human habitat in harmony with nature. Modern Architecture tend to confuse, rather than reinforce, a progressive image of earth-friendly architecture. So, initially it is essential to rethink briefly about modern architecture.

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