



The Centre for Sustainable Design

## Sustainable Innovation 05

Global 'state of the art' in sustainable product/service development and design

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## Abstracts

## Promoting Sustainable Innovation in the UK

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WRAP (the Waste & Resources Action Programme) has established a Retail Innovation Team to work on collaborative projects with retailers, brand owners and their suppliers to reduce the amount of food and packaging waste entering the household waste stream using a design innovation approach. The objective is to encourage a shift from a vicious circle of disposable consumption towards a virtuous circle of sustainable consumption in support of an emerging sustainable consumption and production (SCP) policy in the UK and existing waste minimisation policy. In this article, we illustrate WRAP's engagement and design innovation approach and profile a number of case studies that show how retailers and their supply chains have taken on WRAP's waste minimisation challenge; redesigned some of their product offering; and benefited from the support available through WRAP's Waste Minimisation Innovation Fund. Drawing conclusions from the process, it confirms the important role that sustainable design has in embedding the principles of the Waste Hierarchy in the design and specification of Fast Moving Consumer Goods (FMCGs).

## Reflections: Ten Years of Sustainable Product Development and Design

Martin Charter, Director, The Centre for Sustainable Design, University College for the Creative Arts, UK

The presentation will give a snapshot of key issues and developments over the last ten years including key observations from the recent Sustainable Innovation series of conferences. In conclusion there will be some thoughts on where are we now? And where are we going?

## An Investigation into Limitations and Conflicts When Integrating Ecodesign into the Design and Development Processes of Wireless and RF Products

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This paper identifies the significant Eco-design drivers appropriate to wireless and RF products using as an example the findings of a EU Project on mobile phones. The paper then goes on to consider the feasibility of integrating these requirements into the products in the light of the possible imitations and conflicts arising from the current design and development processes and other design drivers for these products.

It concludes that limitations and barriers to implementing Eco-design exist, caused by current component technologies used in the construction of small wireless mobile devices, dispersed design influence and lack of knowledge in complex design and manufacturing chains and use of current design software for the semiconductor chips and printed wiring boards .

The major environmental aspects of material choice and energy use in the manufacturing phase are determined largely by semiconductor and component technologies and these cannot be easily changed in the short term. Designers and engineers in these industries need to recognise and incorporate environmental improvements in their longer-term product and process development programmes.

Appropriate knowledge and expertise must be disseminated throughout the design and manufacturing chains at the points of influence through sharing of experiences and training.

The constraints and limitations on material choice, physical structure and layout imposed by the design software used needs to be recognised and either lead to modification of the rules imbedded in the software or to manual override where this does not compromise other regulatory requirements.

## **Demonstrating the Potential for 'Integrated Scales of Design and Production for Sustainability' (ISDPS) Concept**

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*Stuart Walker, Professor of Industrial Design, Associate Dean (Research and International), Faculty of Environmental Design, The University of Calgary, 2500 University Drive, T2N 1N4, Calgary, Alberta, Canada*

This paper presents a current research project in sustainable product design. Three parallel strands of the research are covered, which are then brought together to provide fresh insights into design for sustainability. Firstly, the overall concept of 'Integrated Scales of Design and Production for Sustainability' (ISDPS) proposes integrating mass-production with local production to better address a variety of sustainable criteria. Secondly, an example of a contemporary product is examined, which integrates various scales of production in its design, and this is compared to a craft product. Thirdly, design explorations are presented that introduce concepts such as *adaptable* or "*enabling*" design (Manzini, 2005). Finally, these three strands are brought together to better define the feasibility and potential of the "ISDPS" concept (Dogan and Walker, 2004). In this context, the meaning of 'the local' in terms of product availability and adaptability, and its relationship to the underlying sustainability criteria is discussed.

## **Linking Sustainable Product Design with Corporate Social Responsibility: a Consideration of Frameworks and Measurement Tools**

*Sally Edwards, Research Associate, Lowell Center for Sustainable Production, University of Massachusetts at Lowell, 1 University Avenue, Lowell, MA 01854, US*

In this era of globalisation, the explicit linking of sustainable product design with corporate social responsibility can be a significant force towards sustainable development. This paper explores the linkage between sustainable product design and corporate social responsibility. A sustainable product is defined and some tools for assessing product sustainability and corporate social responsibility are reviewed briefly. Barriers to and drivers for sustainable product design are discussed. A brief case study of Mattel's efforts towards corporate social responsibility and product design in the toy industry is included. Sustainable product design cannot be the prime or sole responsibility of designers. It must be part of a firm's overall strategic planning and direction and involve designers, engineers, production workers and company decision makers. Sustainable products can be realised only within a sustainable production system. Regulatory drivers and voluntary incentives are needed to increase innovation in product design, and enhance systems of sustainable production and consumption.

## **The Bridge: Indigenous Knowledge as a Bridge to Sustainable Design**

*Adital Ela, Designer and Post-Graduate Researcher, Allenby 73/15, Tel Aviv 65134, Israel*

This study started with the motivation to explore the meaning of sustainability as it was depicted through indigenous living patterns. It started with the hypothesis that this form of knowledge can potentially transform and become a new focal point enabling us to elaborate the way we practice sustainable design. Indigenous knowledge originating from India was chosen as a case study for this research.

Through the attempt to understand the essence and deep meaning behind this knowledge, a translation process took place with the aim of exploring ways to assimilate it within the current context of living.

The practical outcomes of this process are five design strategies, offering an invitation to a holistic, yet applicable, view of sustainability. Based on these strategies an educational tool named 'The Bridge' was constructed. 'The Bridge' acts as the first step of a collaborative effort aiming to elaborate the proposed strategies into practical outcomes.

## **Processes and Methods for Sustainable Planning in Architecture and Civil Engineering**

*Dipl.Ing. Elmar Erdell, Prof. Dr.Ing. Udo Lindemann, Institute of Product Development, Technical University of Munich, Boltzmannstraße 15, D-85748 Garching, Germany*

This article shows the possibilities of using methods in the field of planning buildings, especially regarding sustainability aims. In several case studies methods were applied in practice. This article points out the experiences concerning the typical problems of the planning process and gives advice for a successful procedure for implementing methods.

Keywords: Architecture, civil engineering, methods, methodologies, planning process.

## **Innovation Communities: an Actor Concept for Explaining Sustainable Innovations**

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On the basis of a conceptual framework for describing and explaining sustainable innovations, the paper introduces an actor-focused concept of "innovation communities". An "innovation community" is understood as a group of key promoters, mostly coming from different companies and organisations that together promote and drive forward a specific innovation idea or project. A community perspective is especially valuable for those sustainability-oriented innovation processes that aim at (product-service) system solutions, radical improvements of the whole life-cycle of a product and technological or institutional innovations that require multi-actor co-operations. The emergence of networking in innovation communities is described on the basis of the "Add-Value-to-Paper" case, an example from the chemical- and paper-industry, which comprises innovation community partners along the whole value chain from the fibre to the printed product.

## **Pathways to Sustainable Innovations Implications for framing and managing corporate sustainable innovations**

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Based on 68 case studies of sustainable innovations from all over the world, the paper presents six typical pathways of how sustainability innovations emerge. Furthermore it discusses their implications for the framing and managing of corporate innovation processes. The results of the research project "Sustainable Markets eMERge" (SUMMER) show that two company competencies are central here: First, corporate context management, and second, the capacity to systematically shape the communication processes and personal encounters needed for successful creation of actor cooperation and networking (interaction management).

Key Words: Sustainable innovations, innovation process, context management, interaction management

## **A New Model of Well-Being to Design 'Products' that Sustain People, Environments and Profits**

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This paper tries to help designers navigate the maze of sustainability issues by developing a simple, qualitative model of well-being that could be used for everyday practice. This model examines the well-being credentials of the enterprise and the product. It examines the three domains of sustainable development (SD), economic, societal and environmental well-being, by assessing the sustainable enterprise qualities of the producer (from business-as-usual to very strong). It places this in context with the four domains of individual well-being - physical, mental, emotional and spiritual – as affected by the product (from harmful to very strong benefit). Results indicate that most enterprises, whether designer-makers, small-medium enterprises (SMEs) or global corporates, are only achieving weak or moderate levels of sustainable enterprise. These eco-design products are generating up to moderate levels of mental and emotional well-being, but generate less well-being in the physical and spiritual domains. Can the model be used to expand the material and non-material affordance of the product? Is it a means to challenge the way we design products and the enterprise. Can this model help explore a more expansive role for design and a means to unite design and business to explore the opportunities presented by the SD challenge?

## **Biological Future: An Argument for the Use and Development of Biodegradable Materials for Design**

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By using biomass as the primary source for our energy and material needs we will contribute to reduce emissions of green house gasses, simplify our disposal and recycling infrastructure and deal appropriately with products for which no feasible collection currently exists. Since living organisms in cycles tightly related to Nature's real capabilities produce biomass, industrial activity would be locked to these sustainable mechanisms. Technological materials would be saved for applications where no biological material performs adequately, and their availability would be guaranteed for a longer period of time. Fewer regulatory and certification

entities will be needed if capital production and waste recycling depends on efficient natural cycles, since industrial activities would rely on healthy ecosystems for their energy and materials supply.

A few cases are mentioned to exemplify different areas of this biological metabolism and the application of "100bio" materials, such as CO<sub>2</sub> balance, availability and cost of raw materials, disposal structures and design limitations and potential.

## Driving Eco-Innovation: Building Organisational Buy-In And Capacity For Sustainable Product Development

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The Dow Corning Corporation (DCC), a joint venture between Corning, Incorporated and The Dow Chemical Company, is a global leader in silicon-based technology and innovation. The company employs 8,800 people and offers more than 7,000 products and services, in sectors such as electronics, automotive, building and construction, personal care products. Dow Corning has identified "Sustainability" as one its Core Values and fundamental to its future success. One the key guiding principles for sustainability is reducing the environmental impact and improving the health and safety aspects of current and future operations, products and services. Implementing this principle will help DCC secure its license to operate and grow by supporting:

- Better identification and management of risks;
- Product and process innovation;
- Meeting or exceeding customer and regulatory requirements; and,
- Deepening relationships with customers that share similar values and strategy.

A key enabler for integrating sustainability into product and technology development processes is engaging senior managers and core business functions in the creation of new project ideas that will demonstrate the benefits listed above and that have support from across the organisation. This paper describes a process that was developed to stimulate project ideas in five key areas: novel chemistry (at both the product and process level), new applications of silicones with customers, material recovery, and enabling policies, programs and tools (e.g., life cycle assessment). The process involved: 1) internal discussions on eco-innovation and where the greatest opportunity for innovation might lie; 2) the solicitation of external expert opinion in the areas identified in the form of white papers; 3) an intensive two-day eco-innovation workshop that brought together external experts from a range of scientific disciplines, the company's Technical Advisory Board, and over twenty DCC scientists and engineers. The session was sponsored by the Chief Technology Officer and it generated a number of substantive project ideas that are now at various stages of evaluation or implementation.

In addition to generating tangible project ideas for the development of more sustainable products and processes, the workshop highlighted the importance of integrating systems thinking into core business processes to ensure better identification of innovation opportunities as well as improved management of risks. This paper highlights the overall sustainability drivers for Dow Corning, the process followed to drive the eco-innovation workshop toward the development of tangible projects and the organisational success factors that have enabled the results of the workshop to land on fertile ground.



## **An Accreditation Scheme in Sustainable Design for Architects**

*Professor Sandy Halliday, Principal, Gaia Research, Edinburgh and Professor in Engineering Design for Sustainable Development, University of Strathclyde, Glasgow, Scotland*

The Royal Incorporation of Architects in Scotland (RIAS) has pioneered the world's first evidence based Sustainable Design Accreditation scheme for architects. The scheme, offers individual designers the opportunity to register their performance in sustainable design and to gain a classification. The accreditation process, which was conceived and developed by the author of this paper, is unique in appraising sustainability competence in that it rewards practical implementation of knowledge rather than relying on training and CPD based evidence. It thereby rewards not what designers know, but importantly what they have been able to achieve.

Applicants are required to submit information on up to three completed building projects and to describe their involvement and achievements. The work is independently peer assessed with higher classifications being awarded on the basis of complexity, scale, technical integration, development of interdisciplinary professional skills and integration of economic and social factors. Innovation is acknowledged at all scales. Designers are required to assess aspects of design that impact on resources, pollution, communities, biodiversity and health through the life-cycle of buildings, not simply at handover.

By only rewarding evidence based achievement it fully acknowledges the clear distinction between simply aspirations and the very real problems to be overcome in seeking to deliver sustainable design. It also draws attention to the nature of buildings as product and process, product and verb; and the vital importance of both these aspects to ecological design.

The paper describes the process that led to the development of the scheme, the scheme requirements, and draws lessons on the state of the profession that arose from it. It offers a view on the benefits of extending the scheme to cover other professions involved in the built environment and beyond, to industrial product designers. The complexity of buildings and the achievement, by inference, of 3<sup>rd</sup> party appraisal of sustainable buildings also provides important guidance to the field of design.

The necessity of a life cycle approach to the design of products has long been recognised as a fundamental of sustainable design. 3<sup>rd</sup> party accreditation schemes that acknowledge materials and products on the basis of their alleviation of environmental impact compared to other similar products have been developing rapidly in recent years.<sup>1</sup> The development of a 3<sup>rd</sup> party appraisal of buildings that recognises the contribution of designers and embraces both process and product is a significant step forward. It is worthwhile considering whether there is a parallel opportunity within other design professions that could enable the scheme to be extended to other products beyond buildings.

## **NGO Initiated Sustainable Innovation - The Case Of Flame Retardants, An Enviro-NGO And A Global Computer Company At The Frontline**

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An initially unintended partnership between an Enviro-NGO (SSNC - the Swedish Society for Nature Conservation) and a large computer company (Fujitsu Siemens) is in focus here. The

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<sup>1</sup> Halliday S.P (2004) Module 14 Appraisal Tools and Techniques Gaia Research

type of innovation process illustrated - that is initiated by a creative demand shaper - is seldom discussed in academia. Many typical traits of this type of innovation processes can be seen in the case:

- The ability of an NGO to spear-head the demand in a new sustainability dimension;
- The existence of souls of fire in both the demand shaping organisation and in the innovating company;
- The need to bridge huge differences in manners of thinking;
- The value of proto-markets where the requirements of the demanding organisations and providing firms can be matched.

We expect that the unsustainable alternatives will be phased out in the future both as a consequence of voluntary actions and due to regulations, taxes, labels, enlightened media coverage or other external factors.

### **A Journey Towards Sustainable Products**

*Andrew Jenkins, Sustainable Development Manager – Products, The Boots Group plc, Head Office D90 West G13, Nottingham, NG90 1BS, UK*

The concerns of product developers have evolved from single issues such as the environmental impact of packaging waste or product safety into the arena of whole product impact and sustainable product development.

How does a major product developer, manufacturer and retailer such as Boots keep abreast of these changes and how can this be harnessed to drive innovation in consumer products in a complex manufacturing and retail business? This case study will examine how product development strategy has evolved at Boots and the processes that have been put in place to make sustainable development a key part of product development.

### **Integrating Sustainability In Design Thinking: A Government Perspective**

*Aphrodite Korou, Senior Policy Advisor, Sustainable Development Policy, UK Department of Trade and Industry, London, UK*

Securing the Future, the new UK Government Sustainable Development Strategy (UK SDS) published in March 2005, recognises the significance of the environmental impacts of our consumption and production patterns and the fact that the inefficient use of resources are a drag on the UK economy and business. In addition, the Strategy acknowledges that a major shift is needed in order to deliver new products and services with lower environmental impacts across their lifecycle, and new business models which meet this challenge while boosting competitiveness. It stresses the importance of better eco-design for improving the performance of products and for stimulating real step changes, highlighting that one way of doing so is by promoting eco-design as a mainstream element of good design practice. The UK SDS is about changing behaviours but consumption patterns are often limited by the goods and services available. The Strategy therefore draws attention to the need for sustainability to be "designed-in" at an early stage of the product cycle and proposes to bring together expertise through a new Sustainable Design Forum to champion and educate in eco-design, and promote best practice tools and approaches which can be adopted by designers.

## Moral Products – the Missing Dimension in CSR?

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In this paper we will discuss some of the problems inherent in the current conceptualisation of Corporate Social Responsibility (CSR) and suggest an alternative approach that builds upon the notion of products as carriers of morality. By focusing on how products and product systems may be seen as both arenas and actors in negotiations about moral responsibility, we want to challenge the idea of human beings and in particular managers as the exclusive owners of moral agency. This approach to CSR and corporate sustainability is highly indebted to Bruno Latour and the field of Science-Technology Studies (STS) where the co-evolution of society and technology has been studied from a constructivist perspective. The most important contribution from this way of framing CSR is that other parts of the organisation might be brought into the discussion about corporate sustainability, thus reducing the risk of inconsistent behaviour. Also other societal and managerial implications will be briefly discussed.

## Investigating Product Driven Sustainable Use

*Debra Lilley, Dr. Vicky Lofthouse & Dr. Tracy Bhamra, PhD Researcher, Research Fellow, Senior Lecturer, Department of Design and Technology, Loughborough University, Loughborough, Leicestershire, UK*

This paper reports on the methodology and findings of a pilot study carried out as part of a doctoral research project at Loughborough University. The PhD aims to identify a methodology for designing products that are instinctively used in a sustainable way. The lifecycle of a product consists of design and development, manufacturing, distribution, sales, use and disposal. The use phase has been identified as having a significant environmental and social impact, which is largely determined by the consumers' behaviour. (Environmental Change Unit, 1997; Margolin, 1997; Sherwin and Bhamra, 1998). To reduce the impact of product use, technological innovation alone is not sufficient, a fundamental shift in behaviour is required (Fletcher et al, 2001; Velden, 2003), a shift which could be initiated by manufacturers through innovative product design. However, with the exception of safety and manufacturer liability, there appears to be a lack of consideration on the part of manufacturers and designers for the effects of product use. To date activities in the field of sustainable design have tended to focus on reducing the impact of manufacturing and disposal a focus which is driven in part, by legislative demands.

## Sustainable Solutions In A Network Society: Social Innovation, Creative Communities and Advanced Industrialisation

*Professor Ezio Manzini, DIS-INDACO, Politecnico di Milano, Italy*

In the next years we will all have to learn to live better reducing the environmental footprint of our actions and producing new forms of social fabric. To move in this direction asks for a major change in the present ways of thinking and doing: how this discontinuity will occur? Where have we to search to find new direction for the technological innovation and to develop sustainable business ideas? My proposal is to look into the contemporary society and to search in it for the *emerging signals* of a possible, sustainable future.

## 1995-2005: Progress and Prospect of Ecodesign in Japan

*Professor Fumikazu Masuda, Tokyo Zokei University, President, open house inc., Japan*

It was 1995, when designers and researchers held the Japan's first-ever ecodesign workshop in Kyoto in cooperation with o2. Since then, the idea of ecodesign became a point of discussion among industries, and government agencies, lead by the Ministry of International Trade and Industry, began drawing a guideline and took initiatives for its support. This movement has initiated in the latter 1990s, meaning it's been only 10 years since the idea was introduced and put into a practice in Japan.

In this short period of time, environmentally-conscious design / development in Japanese industrial products, or the environmental efficiency of products, has improved significantly. Especially, in the field of industrial technology, its performance has been remarkable.

The reasons for the success can be summarised in many ways. Since 1960s, Japan has been accumulating technologies for preventing environmental pollution, and an efficient use of resources for an economic reason. It is because Japan lacks energy resources. So when ecodesign was actually put into a practice recently, Japan has already had technological advantages.

In addition to it, Japanese companies knew practically that an efficient use of resources and a minimisation of cost do not contradict to each other, but also, they knew that it is a source of a healthy competitive market. In another words, executives of companies have a foundation to accept ecodesign as a way to make profit.

This idea is well-supported by the overwhelming number of the technology-driven ecoproducts in Japan, such as hybrid engine automobiles, solar panels, energy saving electric appliances, and digital equipments. Since 1999, Tokyo has been hosting Eco-Products Expo every year. The last year, the Expo attracted 500 companies, or more than 3,000 ecoproducts, and 120,000 attendances through 3 days of the venue. In Japanese manufacturing industry, ecodesign is recognised beyond a "boom" or "trend". It turned out that it has become one of the prerequisites for a product development.

Though there is a massive technological success, Japan is still short of its goal of the Kyoto Protocol, which is to reduce the emission of CO<sub>2</sub> by 6% from the 1990 value, is not bright. The sad fact is, during the past 8 years, the figure has increased by 8%. Why is this happening?

One of the reasons is that the theory of competitive market is left as it is from the past. For instance, if a fuel efficiency of an automobile improves significantly, the expense you pay for gas decreases. This eco-advantage may mislead consumers to purchasing bigger, faster and more energy-consuming automobile. If the energy efficiency of an air-conditioner improves, the cost of electricity can be negligible – may end up turning it on all day long. If paper and aluminum-can recycling rates increase, consumers are likely to spend more, because they can feel that there are abundant resources to consume.

Fundamentally, ecodesign is a tool to boost product's sale, but as a result, the environmental burden by the economic activity grows even further. In order to escape from this dilemma, consumer's so-called "20th century lifestyle", which is based on the mass production and mass consumption, need to be altered.

Is there any possibility for changes? Probably, the possibilities lie under the consumer's consciousness and consumption activities, and we have been observing some indications for changes. But in order to make it more visible, necessary services and products need to be introduced. Unless new options are introduced on the market, consumers can do nothing but keep purchasing the available ones, even though it is not their intentions.

For mega companies that pertain to a rigid and old-style organisation, it will be difficult to introduce such drastic change. In order to develop an appropriate alternative business model and exercise it in the market, companies need to collaborate with users and establish a new model. When such activity occurs, a current one-way communication, a manufacturer to a

market, becomes two-ways communications, and that is the time when appropriate design profession is crucial to act as its interface or a catalytic agent..

From a social and time perspective, design is revising its value of consumption. Its driving force is gradually shifting from a technology to a human mind. When considering new "design for sustainability", a guide to its success is to recognising differences in life styles, which is suited for each country environment. People in Japan, need to face how more than 100 million of people are going to coexist in an environment, called a narrow chain of islands nation, Japan.

It can be said in the other way – how are we going to face enormous number of the population, 6 billion people, and rapidly increasing toward 10 billion, are going to live and coexist in a limited space, called a planet earth.

## **Developing a New SPDS: Sustainable Product Design Specification Tool**

*Christian McLening, Senior Lecturer: Product Design – BSc, Buckinghamshire Chilterns University College, High Wycombe, UK*

*Supervisors: Dr Trevor Dixon & Dr Lyndon Buck*

With the increasing demand for more sustainable products coming from both consumers and through legislation, manufacturers are turning to their designers to provide the right products. Creative designers are now working in a new environment of global markets and tough parameters within which they need to remain creative and commercial. ISO:14062 is a design management focused document that attempts to structure the design of new products, but there are shortcomings in the communication between the management and the creative designer, not least in a different type of language and interpretations.

Designers have always used design tools and methods to structure their work, many may not acknowledge they use a method but would recognise similarities with design tools in their own working. The scope of the designer has expanded as the entire life cycle of the product is now an important issue at conception with designers needing new knowledge and understanding of the entire Holistic life of the products they create.

Sustainability can be split into three basic concepts; environmental, social and economic, with the majority of this work looking into the area of environmental sustainability in mass-produced products.

This research aims to investigate the ways creative designers work within the global environment with specific attention to new product development. How designers deal with customer demands and industry/Government directives for sustainable design is a main focus of the work.

An initial round of questionnaires and 5 semi-structured interviews with a range of different designers has been carried out to help focus the research (The semi-structured interview approach allowed consistency in topic but a little flexibility during the interview depending on the discussion). The group included; automotive designer, medium sized company based designer, product design consultant, business design advisor and a CAD based designer, all to give breadth to this initial stage of the research.

This paper investigates and defines the parameters that will be used to develop a new design tool. It looks at the more traditional design tools and the new Eco-focused design tools to identify positive and negative elements for the working designer. The paper identifies the importance of a sustainable focus at the early concept development stages and indicates the development of a Sustainable Product Design Specification tool direction for further development.

## LCA and Sustainable Innovation in Construction

*Jo Mundy and Katie Livesey, Senior Consultants, BRE, Garston, Watford, Herts, WD25 9XX, UK*

This paper is of interest to anyone designing or developing products, particularly construction products, and to those choosing or recommending the use of products.

The environmental impacts of 1 m<sup>2</sup> of panelised timber frame external wall with a brick skin insulated to a U-value of 0.35 W m<sup>-2</sup>K<sup>-1</sup> with either rockwool or polyurethane and designed to last 60 years were evaluated using Life Cycle Assessment (LCA). Results are the average from four UK timber frame manufacturers, weighted by production level.

The environmental impact of the PU insulated wall was higher than the rockwool insulated wall. The PU insulated wall received a B-rating on the Green Guide to Housing Specification scale, compared with the rockwool wall's A-rating. The results also showed that the brick accounted for the majority of the impacts of both walls, with the timber frame panel itself accounting for only 10% of the total impact.

LCA provides a framework for life cycle thinking that is relevant to any product, system or service. Improvements in environmental performance are possible on multiple levels – within the process itself and from influencing those supplying and using the product.

## ISO 14001 – Management of Sustainable Product Design

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Lucent Technologies' (Lucent) wireless business unit, the Mobility Solutions Group (Mobility Solutions), has successfully developed, implemented and now maintains a Product-Based Environmental Management System (PBEMS) which simultaneously utilises environmental and business processes to manage significant product aspects. Through the PBEMS, sustainability concepts are applied to the design and development of wireless hardware products worldwide. The PBEMS conforms to the requirements of the ISO 14001 international standard and has received third-party certification.

Prior to this, sustainability principles were recognised within Lucent, now they are fully aligned with traditional product realisation processes. *The PBEMS is structured to integrate sustainability considerations into strategic business decisions, product evolution planning and product development.*

Addressing environmental issues during design supports the PBEMS goal of product environmental impact reduction. Engaging the design community in life cycle thinking and encouraging innovation to ensure that succeeding generations of products are designed to enable wiser, sustainable use of natural resources are significant benefits provided by the PBEMS.

## **Managing Functional Sales Systems - Important Aspects for Making Functional Sales an Effective Business System**

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When a manufacturer provides a function rather than simply a physical product to a customer, the function provider needs to consider and develop more than just the physical product. New systems are needed which incorporate service as well as the closed-loop supply chain. By focusing on how to deliver value to the customer in a life-cycle perspective, an effective functional sales solution can be created. This paper is based on previous research along with new case studies at companies operating in functional sales and remanufacturing businesses around the world.

In this paper, the following ten key aspects of managing functional sales systems are identified and described: Matching Customer Needs, Design for Remanufacturing, Delivering the System, Provide Reliability, Provide Flexibility, End-of-use Solutions, Resource Liberations, Minimising Risk, Education and Provide Low-in-use Costs. These aspects are relevant considerations for effectively managing functional sales systems throughout the closed-loop supply chain.

Energy Efficient Product Development for Companies Participating in the Long Term

Agreements II (LTAII) in the Netherlands

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Long Term Agreements are an important Dutch policy instrument. The second Long-Term Agreement on energy efficiency was put in operation in 2001. Participants are sectoral organisations, companies, regional and local authorities and the central government. A new theme in this second agreement is Energy Efficient Product Development. Several instruments are available for companies to identify and realise energy efficiency measures. The two instruments discussed are the Energy Innovation Scan and the Product Service Systems scan. It is concluded that these instruments can aid LTA2 companies in developing plans for the implementation of Energy Efficient Product Development.

## **Integrated Product Policy (IPP) – Practices in Europe**

*Dr. Frieder Rubik, Institut für ökologische Wirtschaftsforschung gGmbH (Institute for Ecological Economy Research), Bergstrasse 7, D – 69120 Heidelberg, Germany*

IPP is a relatively new and promising policy area within environmental policy. Some scientific research has been done and several countries have begun political activities in this area. What is still missing is an international comparative policy analysis of IPP focussing on the important characteristics of IPP. This paper is an attempt at such an analysis and presents an overview of the European IPP-"landscape", i.e. the policy practises of some European States. The paper is organised according to a policy-cycle approach. Some findings are that the embedment of IPP in the sustainability strategies is very different. Any elaboration of (ambitious) IPP-strategies does not necessarily mean that implementation takes place. A

reformulation of IPP has not (yet) happened, but the challenge of sustainable production and consumption patterns influence the development of IPP.

### **Breaking Petroleum Dependency: *Corporate and Stakeholder Partnership for Clean Technologies***

*Bill Shireman, President and CEO, The Future 500, US*

Carbon emissions, global climate change, military tensions, and war – the costs of petroleum dependency continue to rise. Governments alone can't solve the problems - business too must take a leadership role. Breaking petroleum dependency is fundamental to corporate social responsibility.

But doing so isn't easy. Sustainable technologies face very high hurdles: price barriers, performance uncertainties, rigid specifications, fearful procurement officials, nervous companies, perfectionist stakeholders, and an overarching aversion to change. In these remarks, Bill Shireman will use real-world examples to illustrate the steps companies and their stakeholders must take to walk the path from petroleum dependence to sustainability.

His remarks will include:

- Design - design principles for sustainable products and processes
- Demand - harnessing corporate buying power to support mass production
- Coalitions - building stakeholder coalitions to support and drive change
- Continuous Improvement - patiently pursuing continuous improvements

Shireman will draw examples from Hewlett-Packard, Home Depot, Mitsubishi, Cargill, Dow, Coca-Cola and other companies to illustrate the challenges and opportunities that face companies and their stakeholders in the transition away from the resources of the past, and toward resources with a future.

### **Policy Status On Sustainable Consumption And Production At Global Level**

*Guido Sonnemann, Programme Officer, Division of Technology, Industry and Economics, United Nations Environment Programme, France*

The second international review meeting of the Marrakech process (ten-year framework of programmes on Sustainable Consumption and Production) was held in St. Jose, Costa Rica, Costa Rica, 5-8 September 2005. The outcomes of this meeting together with some work progress in UNEP led activities related to sustainable innovation are the highlights to report on the policy status of sustainable consumption and production (SCP) at global level.

The Costa Rica meeting requested UNEP and UN DESA as well as ministries and international and bilateral development assistance agencies active in the Marrakech process to strengthen the linkages between SCP and poverty eradication/ Millennium Development Goals and to focus the work on a limited set of practical working areas, rather than going on with the regional consultation process.

The meeting welcomed the following five priorities for further work in this area proposed by UNEP: (1) industrial development (including circular economy, safer production), (2) waste management (including 3R Initiative), (3) SCP training and capacity building as part of the Bali Action Plan, (4) Sustainable Trade and Resource Consumption (focusing on life cycle thinking and adequate support for SME's in developing countries), and (5) Sustainable Energy and Mobility (renewable energy and improving infrastructure for industrial development, achieving development goals).

UNEP's initiative to set up action-oriented Task Forces led by governments was further developed. As a result four lead countries presented their plans of activities in the plenary session the following day: (1) Sweden on sustainable lifestyles, advertising and youth, (2) UK on sustainable product policies (focusing on raising the requirements of standards and creating incentives for sustainable product development), (3) Germany on co-operation with



Africa (on leapfrogging to SCP), and (4) Switzerland on sustainable procurement. South Korea was said to be willing to lead a task force on "green growth". Task forces for respectively SCP and labour unions, indicators, supply chain management and solid waste management (with the World Bank) are currently under consideration by other countries.

Ongoing and planned work in ongoing UNEP DTIE activities like the Life Cycle Initiative and the promotion of Sustainable Products and Services is following the recommendations from the Costa Rica meeting by 'practice-oriented' task forces with members for all world regions as part of the Life Cycle Initiative and 'on the ground' training in developing countries on product design through National Cleaner Production Centres. UNEP is interested to set up a global think tank on sustainable innovation to support and strengthen the innovation component of future activities.

## **Traditional EcoDesign in Proactive Electronic Companies will be soon Dead! Long live Ecovalue!**

*Professor Ab Stevels, Chair for Applied EcoDesign, Delft University of Technology, Advisor Sustainability Centre, Philips Consumer Electronics, Netherlands*

Traditional EcoDesign in Electronic Companies aims at lowering the environmental impact of products and services over their whole life cycle. Design activities address five focal areas (energy consumption, material application, packaging and transport, chemical content and recyclability). Through environmental performance measurement (for instance by environmental benchmarking or Life Cycle Analysis studies) solutions for conflicting items (like between material reduction and recyclability or between energy reduction and chemical content) are optimised.

In a first stage of its implementation (1990-1995), emphasis has been in specific EcoDesign projects. A lot of awareness has been created. Spectacular successes have been scored as well. The chief reason for this is that the issue was new and a lot of "low hanging fruit" could be picked.

In a second stage (1995-2000) complains has been on business integration through inclusion of EcoDesign in the existing Product Creation Procedures. Particularly in cases where cost reduction and lower environmental impact turned out to be linked further progress could be achieved.

Between 2000 and 2005 proactive companies have increasingly addressed the value chain on a whole, both upstream (suppliers have to contribute to improve environmental performance) and downstream (sell more to customers through green).

Currently EcoDesign is in a proactive kind of crisis. In the opinion of the author, there are three reasons for this:

- Easy technical improvements have been realised, traditional functionalities like TV's with CRT have now limited potential to make a real difference with competitors (limits by "physics", detailed figures will be published).
- Green as such does not sell; 'green' has turned out to be part of total functionality value concept (physical, cost of ownership, immaterial and emotional value) but it is clearly subordinate to other elements like money, convenience and aesthetics.
- Conflicts of interest in the value chain. In several cases the situation applies where a producer invests in further reducing the environmental load but does get limited reward: others in the value chain will be the real beneficiaries and real benefits cannot be recouped.

Such reasons have led to a situation in which there is a kind of "saturation of EcoDesign" at proactive electronic companies. This situation is enhanced by developments in the legislation arena. The implementation of Directives of the European Union could lead to a situation where the playing field will become more and more level thus leading to an elimination of environmental performance as a source of competitiveness.

Below EcoDesign will be positioned in the Functionality and EcoValue concepts. It will be demonstrated that looking primarily from the demand perspective (how do consumers spend

their money) rather than to the supply perspective (what environmental load is involved in production) will be helpful to move EcoDesign into higher years again.

## **Environmental Assessment of Videoconference: New Assessment Methodology for ICT Services Considering Ripple Effects and Performance Indicators**

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The environmental burdens imposed by a videoconference and its ripple effects were evaluated with the life cycle assessment (LCA) method. The carbon dioxide (CO<sub>2</sub>) emissions generated by videoconferences account for 20% of the CO<sub>2</sub> emissions generated by business trip meetings. The ripple effect of saved money has the largest impact of all the videoconference ripple effects. To obtain reliable and acceptable results, as far as possible the functions of a videoconference and a business trip meeting should be the same. Therefore a new method was proposed where a videoconference is assumed to be substituted for every tenth business trip meeting. As a result the total CO<sub>2</sub> emission generated by a videoconference was 30% that of a business trip meeting. To evaluate the different functions of ICT services quantitatively we propose a "performance indicator". As a tentative result a videoconference scores 61 points against 100 points for a business trip meeting.

## **Playing with Hyenas: An Injection for Sustainable Consumption by Adding Input/Output Analysis**

*This abstract is based on the report Consumption Sustained/Playing with Hyenas, written by the authors for the NGO Stichting Natuur en Milieu (www.snm.nl; info@snm.nl), Utrecht, Netherlands*

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With Consumption Sustained/Playing with Hyenas, the authors have developed a novel strategy for the greening of consumption for the Dutch NGO SNM. The framework links micro level product group innovation targets to macro level economic growth and decoupling targets.

After a legitimating chapter, the ratio *impact per euro consumption value* has been computed for all 70 product groups of the Dutch economy. This has been done for each of ten environmental stressors.

Next, the product groups that combine small economic shares with large impact proportions are selected in a graphic way. The selected groups are labeled Hyena. Hyenas are the product groups that ought to improve their impact per value drastically.

To obtain a sustainable consumption in 35 years, the authors propose to organise a transition program for each hyena actors constellation. Co-operation, innovation drive, gradual pressure building, cost optimisation, technical limits, and monitoring are essentials for advance. The authors give long term targets per environmental stressor as indications for development.

Playing with Hyenas calls for a 'second round for action' in environmental product policy. Its methods have been applied to the Dutch economy, but are applicable to any economy with sufficiently detailed economic and environmental data. The authors base their computing entirely on data sets of RIVM and others.

## **The 'Just Floor™' Story: A Case Study on Interface's Exploration of a Sustainable Livelihoods (SL) Business Model in India**

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Interface, the world leader in sustainable practices and modular flooring solutions, is exploring an innovative new business model for the development of a European designer range which addresses both the social and environmental aspects of sustainability.

The JUST Floor™ project seeks to fit within the framework of a 'Sustainable Livelihoods' (SL) business model. The World Business Council for Sustainable Development (WBCSD) defines SL business models as 'doing business with poor in a way that benefits the poor and benefits the company'. This SL model will be developed in collaboration with a local partner organisation to deliver innovative and truly sustainable flooring solutions to Interface, which can be manufactured in India, and validated through fair trade style partnerships.

This case study paper discusses the Interface approach to innovation, the use of external networks, and the implications of the exploration of this new business model.

## **New Business for Old Europe: Creating Sustainable Product Service Systems**

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If our goal is a sustainable future for all citizens of the world, a lot of concepts developed in the past are not very helpful any longer. We need to integrate in all product and service developments and innovations the right questions, the right approach and the right motivation.

Product Service System (PSS) development is an interesting approach, because by looking at the bigger picture, i.e. the whole system and not just one product or one service, the potential for radical improvement is high. However research showed that it is not the golden path to a sustainable future, but it depends on the design of the systems, whether PSS are more or less sustainable compared to existing solutions. At the end a lot of specific factors decide about the real progress within the system towards sustainability, from (political) frame conditions via rebound effects to customer acceptance. This paper summarises results of several European and German research projects on (sustainable) product service systems and presents lessons learned.