

## Selected Sustainable Design Resources

Compiled by Laura L. Barnes, GLRPPR Help Desk Librarian

### Books & Reports

Charter, Martin, ed. *Sustainable Solutions: Developing Products and Services for the Future*. London : Greenleaf Publishing, 2001 (ISBN: 1874719365)

'Sustainable Solutions' provides state-of-the-art analysis and case studies on why and how cutting-edge companies are developing new products and services to fit 'triple-bottom-line' expectations.

McDonough, William; Braungart, Michael. *Cradle to Cradle : Remaking the Way We Make Things*. New York: North Point Press, 2002. (ISBN: 0865475873)

The authors propose that products should be designed so that, after their useful life, they provide nourishment for something new-either as "biological nutrients" that safely re-enter the environment or as "technical nutrients" that circulate within closed-loop industrial cycles, without being "downcycled" into low-grade uses (as most "recyclables" now are).

Rothenberg, Sandra; Lenox, Michael; Jordan, Benjamin; and Field, Dr. Frank III. *Alpha Motors, LTD. : Integrating Live-Cycle Environmental Concerns into Product Design : Case Study and Teaching Note*. [Baltimore, MD ?] : World Resources Institute, 1998. (Order online at <http://www.wristore.com/almotltdinli.html>. Cost is \$2.50)

Alpha Motors, a subsidiary of a large U.S. automaker, sought a life-cycle analysis (LCA) tool that could help product designers take account of environmental issues when making materials choices. The primary teaching objective of this case is to give students a basic understanding of LCA and the issues involved when integrating life-cycle tools into the product design process.

Ryan, John C.; Durning, Alan Thein . *Stuff : The Secret Lives of Everyday Things*. Seattle, WA: Northwest Environment Watch, c1997. (ISBN: 1886093040) (There is a companion curriculum guide available online at [http://northwestwatch.org/indicators/stuff\\_curriculum.pdf](http://northwestwatch.org/indicators/stuff_curriculum.pdf))

*Stuff: The Secret Lives of Everyday Things* takes you to the places and people you touch every day-when you sip your coffee, tie your shoes, click your mouse, or step on the gas. Once you follow a day in the life of an average North American and see the secret lives of your food, your clothes, and your toys, your world will never look the same.

Sawhney, Nitin. *ThinkCycle: Supporting Open Collaborative Design for Product Innovation and Learning in Sustainable Engineering* (Thesis Research Abstract). Cambridge, MA :

Massachusetts Institute of Technology, 2002. (Online at <http://web.media.mit.edu/~nitin/thesis/thesis-research-summary.pdf>)

### Journals

*Journal of Sustainable Product Design*

<http://www.kluweronline.com/issn/1367-6679>

A peer-reviewed, multi-disciplinary journal focusing on the theoretical, methodological and practical dimensions of sustainable and eco-product and service design and development.

Currently published by Kluwer Academic Publishers. Subscription rates are \$205/year for institutions and \$100/year for individuals. Archived issues from 1997-1999 are available at <http://www.cfsd.org.uk/journal/archive/index.html>.

### ***Metropolis Magazine***

<http://www.metropolismag.com/>

Focus on products from the designer's perspective. See the Sustainable Metropolis part of the site (<http://www.metropolismag.com/cda/sustainable.php>) for current articles about sustainable design.

## **Web Sites**

### **Biothinking for Sustainable Design and Business Vitality**

<http://www.biothinking.com/>

This website aims to be an educational resource for people wishing to understand how the world, both manmade and natural, operates along biological principles. Biothinking results in products, processes and business models that are adaptable, sustainable and well suited to their niche. Includes a publications section at <http://www.biothinking.com/pubs.htm>.

### **The Natural Step**

<http://www.naturalstep.org/>

The Natural Step's mission is to accelerate global sustainability by guiding companies and governments onto an ecologically, socially and economically sustainable path. They work with some of the world's largest resource users to create solutions, innovative models and tools that will lead the transition to a sustainable future. See in particular the section on sustainability and design at [http://www.naturalstep.org/research/sust\\_and\\_design.php](http://www.naturalstep.org/research/sust_and_design.php).

### **Sustainable Product Design**

[http://www.egeneration.co.uk/centre/modules/sustainable\\_productdesign/](http://www.egeneration.co.uk/centre/modules/sustainable_productdesign/)

A best practices section of the U.K.-based E-generation Business Education Centre.

### **ThinkCycle**

<http://www.thinkcycle.org/>

ThinkCycle is an academic, non-profit initiative engaged in supporting distributed collaboration towards design challenges among underserved communities and the environment. ThinkCycle seeks to create a culture of open-source design innovation, with ongoing collaboration among individuals, communities and organizations around the world.

### **U.S. EPA's Design for Environment Program**

<http://www.epa.gov/dfe/>

The Design for the Environment (DfE) Program provides decision-makers with information, tools, and incentives to make informed decisions that integrate risk, performance, and cost concerns into business decisions. For a complete list of past and present DfE partnership projects, see <http://www.epa.gov/dfe/projects/index.htm>.

## Conferences

### **4<sup>th</sup> International Conference on Design and Manufacture for Sustainable Development**

University upon Tyne at Newcastle upon Tyne, U.K.

July 12-13, 2005

<http://www.liv.ac.uk/sustain/>

The objectives of the conference are: to engage all stakeholders who can help take design and manufacturing forward towards sustainability; to stimulate technical and scientific discussions on sustainable development and the implications for manufacturing industry; to provide a focus for the exchange of the latest ideas and developments on sustainable product lifecycle, from design to disposal and; to evaluate the total impact of sustainable development principles on product design and manufacture.

### **Designing for the 21<sup>st</sup> Century III**

Rio de Janeiro, Brazil

December 7-12, 2004

<http://www.designfor21st.org/>

This event provided opportunities for the growing number of practitioners and promoters of universal design to engage with each other as multi-disciplinary colleagues. Proceedings are online at <http://www.designfor21st.org/proceedings/>.

## Research Centers

### **Centre for Sustainable Design**

<http://www.cfsd.org.uk/>

The Centre for Sustainable Design, established within the Faculty of Design at The Surrey Institute of Art & Design, University College in the U.K., facilitates discussion and research on eco-design and environmental, economic, ethical and social (e3s) considerations in product and service development and design. This is achieved through training and education, research, seminars, workshops, conferences, consultancy, publications and Internet. The Centre is also an information clearinghouse and a focus for innovative thinking on sustainable products and services.

### **Sustainable Systems Research Center**

<http://www.ssrc.rit.edu/>

Based at the Rochester Institute of Technology, the Sustainable Systems Research Center is dedicated to enhancing the environmental and economic performance of products. They do so by developing and enhancing the tools of sustainable design, a holistic approach to maximizing value and minimizing environmental impact.

## Journal Articles

Borland, N.; Wallace, D. "Environmentally Conscious Product Design : A Collaborative Internet-based Modeling Approach." *Journal of Industrial Ecology*, 3(2 & 3), 33-46 (1999).

Buxton, A.; Livingston, A.G.; Pistikopoulos, E.N. "Reaction Path Synthesis for Environmental Impact Minimization." *Computers & Chemical Engineering*, 21, S959-S964 (1997).

Abstract: Reaction path synthesis, the generation of a network of alternative reaction routes for the manufacture of a desired product and the selection of an optimal route, represents a key step in arriving at environmentally sound process designs. In this paper a systematic procedure for organic reaction path synthesis is described in which minimum environmental impact considerations are incorporated in order to exploit the earliest opportunities for waste reduction.

Charter, Martin. "Managing Eco-design." *Industry and Environment* 20(1-2), 29-31.

Abstract: Business is focusing increasingly on products' environmental performance. Product design and development that considers a product's environmental impacts is a new area. 'Eco-design' or 'Design for Environment' (DfE) refers to the systematic incorporation of environmental factors at this stage. To move beyond this stage towards 'Design for Sustainability' (DfS) or 'Sustainable Product Design' (SPD), new structures, skills and systems will be required.

Finster, Mark; Eagan, Patrick; Hussey, Dennis. "Linking Industrial Ecology with Business Strategy : Creating Value for Green Product Design." *Journal of Industrial Ecology*, 5(3), 107-125 (2001).

Abstract: As organizations practice environmental design, some discover green design positively impacts business performance. This article demonstrates how an organization can employ existing design methods and tools with the Kano technique to craft an environmental product design strategy that enhances its business strategy. These tools expand the toolbox of the industrial ecologist and enable the link between green design and business improvement. The Kano technique was developed in the 1980s to facilitate design of innovative products. We also introduce terminology and concepts such as "voices of the environment", "environmental knowledge management", "environmental profile", and "environmental product attribute" in order to bridge the gap between industrial ecology and business concerns.

Hoffman, W.F. III. "Recent Advances in Design for Environment at Motorola." *Journal of Industrial Ecology*, 1(1), 131-140 (1997).

Abstract: Motorola is a large electronics company that uses design for environment (DfE) to address customers' environmental needs. In working to integrate environmental considerations into product design, Motorola has encountered new challenges in product design, and as a result has had to develop new frameworks and employ new analytical tools. This article describes those challenges and Motorola's efforts to date.

McDonough, W; Braungart, M. "Towards a Sustaining Architecture for the 21st Century: The Promise of Cradle-to-cradle Design." *Industry and Environment* 26(2-3), 13-16 (2003).

Abstract: Cradle-to-cradle design is an ecologically intelligent approach to architecture and industry that involves materials, buildings and patterns of settlement which are wholly healthful and restorative. Unlike cradle-to-grave systems, cradle-to-cradle design sees human systems as nutrient cycles in which every material can support life. Materials designed as biological nutrients provide nourishment for nature after use; technical nutrients circulate through industrial systems in closed-loop cycles of production, recovery and remanufacture. Following a science-based protocol for selecting safe, healthful ingredients, cradle-to-cradle design maximizes the

utility of material assets. Responding to physical, cultural and climactic settings, it creates buildings and community plans that generate a diverse range of economic, social and ecological value in industrialized and developing countries.

Oakley, B. T. "Total Quality Product Design--How to Integrate Environmental Criteria into the Product Realization Process." *Total Quality Environmental Management*, 2(3), 309-321 (1993).  
Abstract: This article shows how the marriage of corporate environmental stewardship and TQM, better known as TQEM, is particularly well suited to the area of product design and why environmental health and safety experts can improve a product's environmental performance.

Rios, P.; Blyler, L.; Tieman, L.; Stuart, J.A.; Grant, E. "A Symbolic Methodology To Improve Disassembly Process Design." *Environmental Science & Technology (ES&T)* 37(23), 5417-5423 (2003).

Abstract: This paper introduces the concept of design symbols to help the operator more efficiently survey product complexity with respect to location and number of fasteners to remove a structure that is common to all electronics: the housing. With a sample of 71 different computers, printers, and monitors, we demonstrate that appropriate symbols reduce the total disassembly planning time by 13.2 min. Such an improvement could well make efficient the separation of plastic that would otherwise be destined for waste-to-energy or landfill. The symbolic methodology presented may also improve Design for Recycling and Design for Maintenance and Support.

Rounds, K.S.; Cooper, J.S. "Development of Product Design Requirements Using Taxonomies of Environmental Issues." *Research in Engineering Design*, 13(2), 94-108 (2002).  
Abstract: In this paper, the authors develop and apply three approaches for preparing taxonomies that assist in gathering, storing, using, and reusing Design for Environment requirements.

Segar, J.W.; Bradfield, S.L.; Wright, J.J.; Realf, M.J. "EcoWorx, Green Engineering Principles in Practice." *Environmental Science & Technology (ES&T)* 23(23), 5269-5277 (2003).  
Abstract: The 12 Principles of Green Engineering have been proposed as a framework within which to examine existing products and guide their redesign as well as to evaluate new product designs. The EcoWorx system represents a recyclable carpet tile product that is assessed using the 12 Principles of Green Engineering and cradle-to-cradle design principles to evaluate environmental, qualitative, and economic performance as compared to existing Shaw carpet tile products.

Sheng, Paul; Worhach, Paul "A Process Chaining Approach toward Product Design for Environment." Sheng, Paul; Worhach, Paul. *Journal of Industrial Ecology*, 1(4), 35-55 (1997).  
Abstract: This article presents an approach toward product design for environment (DfE) at the level that integrates environmental hazard analysis with models of transformation processes.

Stephan, David G.; Knodel, Robert M.; Bridges, James S. "A "Mark I" Measurement Methodology for Pollution Prevention Progress Occurring as a Result of Product Design Decisions." *Environmental Progress*, 13(4), 232-246 (1994).  
Abstract: A methodology for assessing progress in pollution prevention resulting from product redesign, reformulation, or replacement is described. The method compares the pollution

generated by the original product with that from the modified or replacement product, taking into account, if desired, the various lifecycle stages of the product. The pollution prevented (or sometimes increased) as a consequence of the redesign is delineated with respect to the media affected (water, air, or soil/groundwater) and with respect to three "categories" of pollution impact (human health impacts, use impairment impacts, and disposal capacity impacts).

Taraska, J. "Some Disassembly Required." *Metropolismag.com*, July 2004, 2 p. (2004). [Online at [http://www.metropolismag.com/html/content\\_0704/ste/](http://www.metropolismag.com/html/content_0704/ste/)]

Abstract: With Think, Steelcase creates a comprehensive environmental strategy that reconfigures all aspects of the manufacturing process -- from the chair's initial conception to its eventual disassembly. The result is an elegant, ergonomic, and environmentally sustainable midpriced office chair.

Thurston, D.L.; Srinivasan, S. "Constrained Optimization for Green Engineering Decision-Making." *Environmental Science & Technology (ES&T)* 37(23), 5389-5397 (2003).

Abstract: Green engineering requires the designer to consider a very extensive set of environmental impacts. To minimize these impacts, the designer must significantly expand his or her "toolset" of product design concepts, alternative materials, manufacturing systems, and analytic methods for addressing life cycle impacts. This can overwhelm a designer, who then resorts to overly simplistic rules or checklists out of necessity. The central issue is how to identify all "pollution prevention pays" opportunities and then how to deal with the unavoidable tradeoffs that arise after all these opportunities have been exhausted. This paper presents a framework for employing mathematical decision modeling toward this end.