Design rescues products from the scrap heap

Engineers strive to design 'green' products economically before legislation requires it

Eastman Kodak Co.'s single-use camera recycling program has recycled 42 million cameras to date.

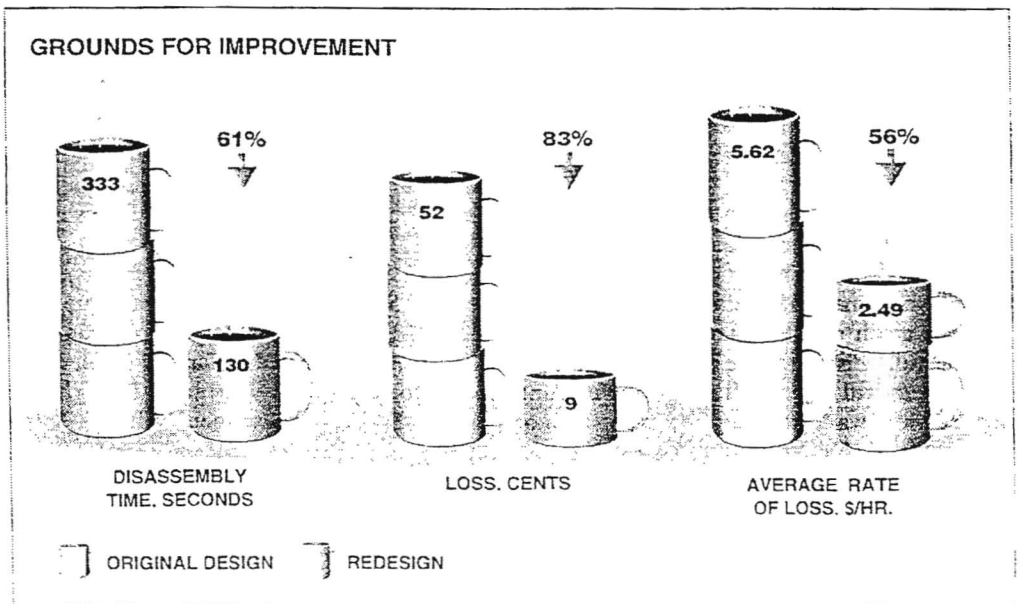
Newton, MA—Eastman Kodak Co., Rochester, NY, designs for recyclability and reuse. Others call it Design for Second Profitability, Environmentally-Conscious Design, Life-Cycle Design, or Design for the Environment (DFE). Whatever you call it, environmental considerations in the concept phase of design stand to have a major impact on company profits and our natural resources.

"One of the certainties of life is death. Companies need a product design that is easily and quickly broken down," says Sandy Munro, president and product development consultant, Munro and Associates, Inc., Troy, MI. "In the future there will be penalties for products not easily scrapped—manufacturers will lose money if they don't deal with this now."

With legislative, financial, and awareness issues to face, many large corporations and universities are working to design products with the products' imminent demise in mind. Engineers are asking: How can this product be designed for remanufacturability, recyclability, or a combination of both? Cases in point:

- Currently, 94 percent of all cars and trucks scrapped in the U.S. are dismantled and shredded, and 75 percent of their content by weight—including the iron, steel, aluminium, and copper—is recycled. Batteries, engines, transmissions, catalytic converters, and radiators are often removed and remanufactured or recycled.
- Ford Motor Company's, Dearborn, MI, vehicle recycling program's two-pronged strategy uses materials from recycled products such as soda bottles in today's vehicles, while making the entire vehicle itself more recyclable. So far, more than 50 million recycled plastic soda bottles a year are finding new life as grille reinforcements, luggage rack side-rails, or door padding.
- The 1995 Ford Explorer, Ranger, Contour, and Mercury Mystique are more than 80 percent recyclable. And Ford is not alone. Chrysler and General Motors offer examples of green design as well.

Many U.S. firms, such as Kodak and Xerox, Rochester, NY, view Germany's proposed legislation, requiring manufacturers to be responsible for disposing and recycling products at the end of the life cycle, as a sign of what lies ahead. So, engineers considering a design must look at manufacturing and service costs, and then beyond to the cost of



Work on a small coffee maker that reduced the number of separate items from 84 to 58 helped bring the University of Rhode Island's IME department a Samsung contract for 'green' designs.

disposal and recycling.

Products that are designed to be easier and cheaper to recycle or reprocess will keep companies in the black and ahead of their competition. Munro says that showing companies there will be a decrease in profit from their products in the future if they are not recyclable, will motivate them to move toward green design. "It *will* be in the future; this is not an 'if' or a 'maybe.' Green design is just a matter of time," he predicts.

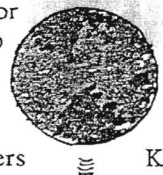
Kodak offers a perfect example. In a program loosely modeled after soft drink company soda can returns, Kodak's single use camera recycling initiative salvaged parts and materials from 41 million single-use cameras. A snap-together, snap-apart design simplifies the part and material recovery process. Of the total number of 'new' cameras shipped in any month, more than 75% are now returned for recycling. "We believe that for consumer recycling this program is second only to the soft drink industry," says Al Vandamore, Kodak's senior project engineer.

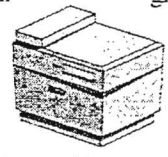
A small mark made inside each disassembled camera mechanism shows the number of times the camera has been recycled. Many cameras now bear five marks.

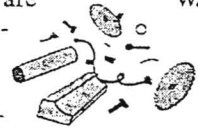
In fact, Kodak reuses up to 85% of the parts, claims a company spokesperson. The design of the camera makes it possible to reuse much of the camera without fully disassembling it. The paperboard outer shell is burned in a waste-to-energy incinerator. Kodak grounds up other parts of the cameras that don't pass inspection and adds them into the raw material stream for molding into new cameras, significantly decreasing need for virgin plastic.

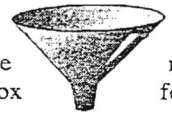
The Kodak initiative is a closed-loop system. The cameras are sealed so consumers must return them to photofinishers to have their pictures developed. Kodak reimburses photofinishers five cents for each camera returned and pays all shipping costs.

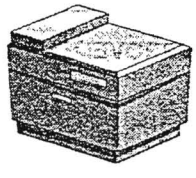
Another natural. Xerox also is serious about design for recycling. According to Patricia Calkins, manager, resource conservation projects, "Remanufacturing engineers work with product design teams to design for remanufacturability. There's a drive towards waste-free products."











One example of recycling and remanufacturing at Xerox involves the 5028F Copy Cartridge. When old cartridges are returned either by customers (a self-addressed, post-paid return envelope is provided with each new cartidge) or technical representatives, they are disassembled. Xerox reuses or recycles about 97% (by weight) of the parts and assemblies. For example, the company grinds up plastic parts and reuses the resin.

Most Xerox products are returned and remanufactured, including the 5018, 5028, 5328, and 5334 copiers. In fact,Xerox designed the 5021 to use up a surplus of 5018 and 5028 hulks.

"We want to get to the important components. They are designed to come apart so we can replace worn parts and reassemble to new machine quality and reliability standards. These machines are not refurbished. There's a full warranty because they function like a new machine," says Calkins.

Work progresses at the university level as well. Last autumn, Samsung Electronics Corp. of Korea awarded University of Rhode Island's (URI) Industrial and Manufacturing Engineering Department (IME) a contract for product redesign studies in the area of Design for Disassembly, Service, and the Environment. According to Winston Knight, professor and chairman of the IME program, the research entails looking into the disassembly and total life cycle analysis of three Samsung appliances.

Fewer parts. In a separate project, Boothroyd-Dewhurst Inc. (BDI), Wakefield, RI. Consultant and URI Professor Geoffrey Boothroyd and his research assistant, Anthony Girard, modified the design of a coffee maker to incorporate fewer parts, making it easier and faster to disassemble. The next step consists of making the most valuable parts also the most accessible parts.

BDI Design for Manufacture and Assembly (DFMA)® software assisted in appliance disassembly early on in the program. BDI has taken the information collected so far and applied it to a preliminary Design For Environment software package. This work should lead to a Beta version of DFE software targeted for testing in late 1995 or early 1996.

The URI researchers encourage engineers to consider disposal when designing products. They also warn that early in the design cycle engineers must consider whether combinations of materials and/or assembly processes will seriously impact the cost of , or even prevent, recycling efforts. For example, although the marking of plastics for recycling is becoming widespread, this may be to no avail if different plastics (or different colors of the same plastic) are used with assembly methods that render separation difficult or impossible. Similarly, such items as labels, surface coatings, adhesive, and paints applied to plastic parts, may make them difficult or impossible to recycle.

Nabil Nasr, assistant professor of Industrial Manufacturing and Engineering Department, Rochester Institute of Technology (RIT), agrees that designers must be aware that when they combine materials, it can make recycling costly, difficult, and, sometimes, not even feasible. "If the customer asks for a certain kind of paint, the customer needs to be made aware of the problems at the recycling stage," explains Nasr.

"As a product is being used you have to replace units, but at some point you reach the retrieval stage, where product life is over. There are three options: disassembly, recycling, remanufacturing. Ultimately we are trying to establish design practices that make remanufacturing possible," continues Nasr.

When reliability is achieved in a green design, engineers will not only help the planet, they will provide companies with new sources of revenue and a positive public image. dn

—Gail M. Considine,
Staff Editor

Did you find this article useful? If so, let us know. Circle No. 520 or reach us at dn@cahners.com