

# Reverse Logistics Provides Green Benefits

*No longer just a way to handle returns, reverse logistics provides an environmentally-friendly method of recovering and reusing parts and materials after a product's life cycle has ended. In many cases it can also add "green" to the bottom line.*

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Ray Kulwiec

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**I**n Japan, any products purchased by the government must, by law, have a specific content of recycled materials.

In The Netherlands, manufacturers are held responsible for the collection, processing, and recycling of used products such as refrigerators, washers, freezers, TVs, and consumer electronics items and their associated packaging.

In the European Union (EU), a directive on handling waste from electrical and electronic equipment has been issued and member states are working on national legislation to implement it.

In the United States, there are hundreds of environmental laws and regulations within individual states, as well as the federal government, which include mandates for recycling operations and responsibility for packaging recovery. However, more research is needed, and a more clear-cut and comprehensive approach needs to be established.

Environmentally-friendly manufacturing and distribution operations are growing in many parts of the world. There are three

driving forces for this trend: 1) environmental laws and regulations are increasingly widespread, 2) consumers are becoming receptive to products made from recycled as well as virgin materials, and 3) some companies are finding recycling, remanufacturing, and processing of used products, materials, and packaging to be good business that represents additional sources of revenue.

## In Brief

Global attention and commitment to environmentally-friendly operations encompasses reverse logistics. In this article, author Ray Kulwiec explores related initiatives by Coors Brewing Company and Dell. Reverse logistics is much more than a means of handling returns and recovering/reusing discarded parts; it extends to design and other elements of the product's life cycle. Incentives for environmental performance improvement, in addition to ethical and regulatory concerns, often include financial benefit as well.

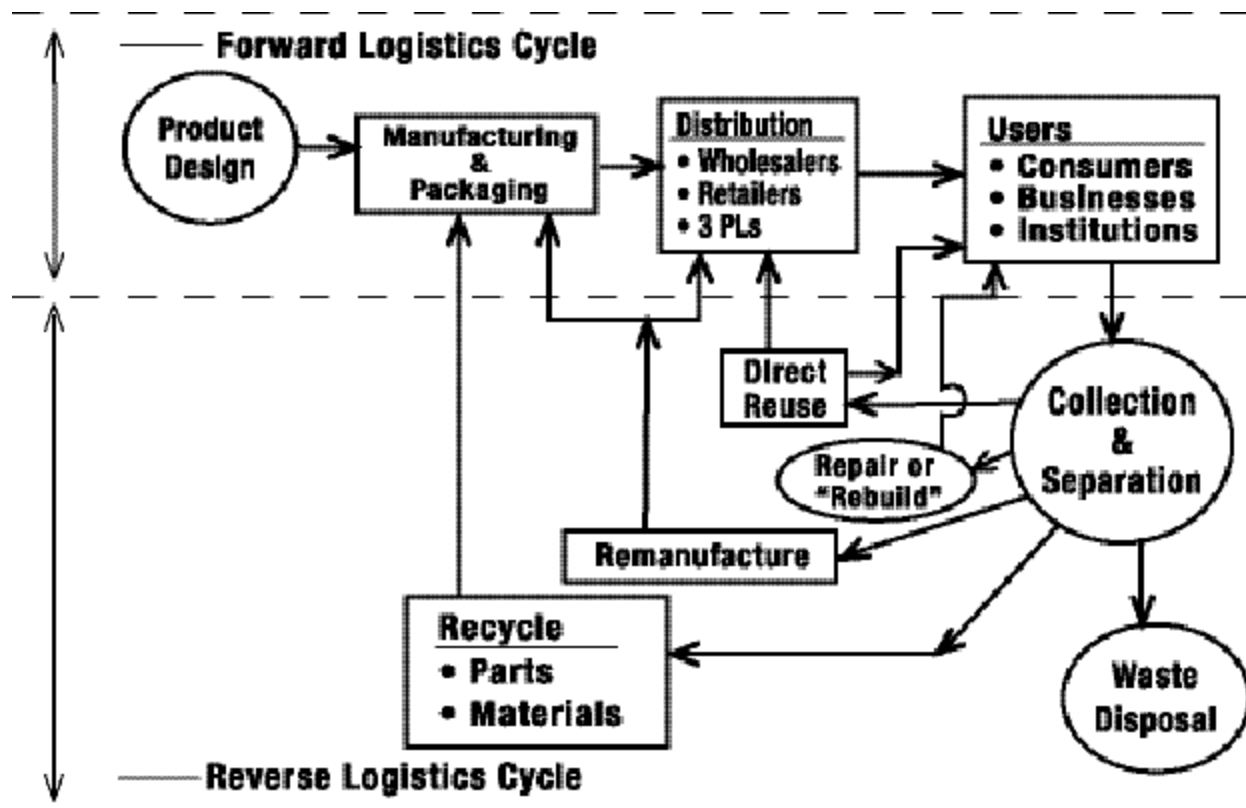
## The Reverse Logistics Approach

A major weapon in the fight against environmental damage is reverse logistics. One view of reverse logistics is the handling of "returns," especially in such areas as TV shopping, retail, and mail-order operations. Certainly some operations of this type have a significant percentage of returns, and often separate systems are set up for dealing with returned merchandise and its reuse and resale.

Today, reverse logistics takes on a broader scope. It involves recycling and reuse of materials contained in a product and its packaging, after that product's useful life has ended. Reverse logistics is a

departure from landfilling or incinerating used-up materials — practices that are no longer acceptable in many situations. In place of landfilling or incineration, reverse logistics includes recycling, material substitution and reuse, and remanufacturing. It takes in all the logistics steps involved in collecting, disassembling, and processing used products, parts, materials, and packages to provide an environmentally safe method of recovery (see Figure 1.)

To be successful, reverse logistics must encompass the entire supply chain. Trading partners have to work together to ensure that the reverse logistics process is linked across all levels of the chain.<sup>1</sup>



**Figure 1.** Reverse logistics is performed after a product's useful life has ended. It involves recovery of parts and materials from outdated or used-up products, with an eye toward protecting the environment. In some cases a product may still be directly reusable, after some cleaning or minor adjustment. In other cases, products and their components are totally unusable, and are disposed of as waste. However, a large proportion of used products and parts can be rebuilt, remanufactured, or recycled back for use in manufacturing the same product or different products. An ideal is integrating forward and reverse logistics cycles together into a closed-loop system.

## The Environmental Management System

ISO 14001 is the primary international standard for environmental management systems. Dell's manufacturing facilities and several business functions are ISO 14001 certified. Their environmental management system contains the following components:

- Identifying environmental impacts within manufacturing and other activities
- Setting environmental goals, measuring performance, and reviewing progress
- Establishing procedures for reducing and controlling risks and impacts of its activities, responding to emergencies, and taking corrective action
- Communicating policies and requirements, and training employees, contractors, and others at company sites
- Maintaining records and documentation
- Auditing compliance with regulations and performance of the management system.

### *The European Example*

Europe has long had a strong and vocal "green" movement. Today that movement has been translated into specific mandates that manufacturers will have to follow in order to do business in Europe. A leading country in this regard is The Netherlands, which adopted reverse logistics legislation in 1999.

Under the Dutch program, manufacturers must not only develop a plan for manufacturing and distributing products, but must also plan for the eventual recycling and reuse of those products and their components after the last user has disposed of them (that is, after their primary life cycle has ended). This planning process may go all the way back to designing the product for ease of disassembly and recyclability. In any case, producers (manufacturers) and importers have final "producer responsibility" for the collection, processing, and recycling of both "white goods" (such as refrigerators, coolers, freezers, washing machines, and hair dryers) and "brown goods" (such as TVs and loud speakers).<sup>2</sup> Typically, the actual collection is performed on a fee arrangement by retailers and municipalities. Consumers do not incur a cost.

A typical logistics path may be the following: Used goods may be picked up from the user by a retailer. The used product is then picked up from the retailer's distribution center by a third-party logistics provider (3 PL), and delivered to a processor. The processor then removes harmful

substances, disassembles and separates parts and materials, and sells these parts and materials to firms specializing in remanufacturing products using these contents. Processors are required to attain a recycling rate of 75 percent; that is, 75 percent of the total weight of the collected, discarded goods must be made available for reuse. Other related logistics paths may include use of municipal depots or regional transshipment stations.<sup>3</sup>

Following the Dutch example, the EU has issued a directive on waste from electrical and electronic equipment (WEEE). The directive sets criteria for the collection, treatment, recycling, and recovery of WEEE. It makes producers (manufacturers) responsible for financing most of these activities. Householders can return WEEE at no cost.

Currently many EU member states are working on national legislation to implement the terms of the directive. The UK, for example, is performing a total review at this writing, with a final implementation plan expected to be available later in 2006. A major issue is how to promote environmental benefits without placing undue financial burden on producers.<sup>4</sup>

### *Reverse Logistics Research*

Research on reverse logistics is being conducted in Europe by teams from the following universities: Erasmus University (Rotterdam, The Netherlands), Aristoteles University of Thessaloniki (Greece), Eindhoven University (The Netherlands),

Several different types of recovery can be pursued ...

INSEAD business school (France), Otto-von-Guericke University (Magdeburg, Germany), and University of Piraeus (Greece). The mission of the group, called RevLog, is to: 1) analyze key issues of reverse logistics, 2) order the issues according to their impact on various industries and society, and 3) build a framework linking these issues.<sup>5</sup>

In the United States, reverse logistics research is supported by the Reverse Logistics Executive Council, an association of practitioners and academics. The headquarters is the Center for Logistics Management, University of Nevada, Reno. Another relevant group is the Reverse Logistics Association, a Fremont, CA-based trade association for third-party service providers who provide reverse logistics services for OEM manufacturers and others.

Research in reverse logistics deals with the following issues:

- What options are there for recovering parts and materials from used products?
- How will the recovery be accomplished?
- Who will do it?
- Can the recovery procedures be carried out within the structure of traditional manufacturing and distribution operations?
- What are the costs and benefits, from both economic and environmental perspectives?

### **Recovery Methods**

Several different types of recovery can be pursued, including the following:

*Reuse in present form.* In some cases, products can be reused directly, after cleaning and/or some degree of reconstruction. Used pallets and bottles are examples of such products.

*Recycled reuse.* Some or all of the parts and materials from returned products may be routed to a production or assembly process for making the original product or a different product.

*Reuse after repair.* A part or material may be repaired, and utilized as a "rebuilt" or "used" product, which may be of lower quality than the original product.

*Reuse after remanufacturing.* After a product is completely disassembled, its parts and modules are examined and either repaired or replaced. Some upgrading may be performed to make the parts applicable to newer models. Generally, remanufactured products come with warranties comparable to those of totally new products.

### **Green Programs Add "Green" to the Bottom Line**

As time goes by, U.S. companies will have to gear up their commitment to environmental well-being. Even today, they have to comply with environmental regulations in various countries abroad, and soon in most if not all of the EU. In the United States, a number of states have considered various laws and regulations to encourage recycling of used electronics. Currently California, Maryland, and Maine have regulations covering recycling of used computers.

However, mandated compliance is only part of the picture. Recent ongoing research findings demonstrate that companies with the best environmental programs experience significant operating benefits compared to those with the worst or non-existent programs. Benefits include greater growth in operating income, higher sales-to-assets ratio, greater sales growth, higher earnings-to-assets ratio, higher return on investment, and greater return on assets. The following discussion provides two examples of companies with outstanding environmental programs: Coors Brewing Company in the process industries, and Dell in the electronic manufacturing industries.

### **Coors Brewing Company's Environmental Programs**

In 1959, Coors Brewing Company introduced the aluminum beverage can and aluminum can recycling shortly thereafter. Consumers were willing to participate in can recycling, and the initiative was a success. Throughout the following years, Coors has included environmental responsibility as an ongoing part of its business

plan. In March 1990, the company formally adopted the Adolph Coors Company Environmental Principles. The most recent version (called U.S. Environmental, Health & Safety [EHS] Commitment and Policy), adopted last December and signed by President and CEO Frits van Paasschen, states in part, "We believe that good business practices embrace environmental stewardship. We are committed to protecting the environment by reducing the environmental impacts of our day-to-day operations at every stage of our product life cycle."<sup>6</sup>

### **Recycling Programs**

Coors follows various major recycling activities to achieve both environmental and bottom-line benefits. The following are a few examples.

**Glass.** A Coors partner, Rocky Mountain Bottle Company, purchases 79,000 tons of used glass, or cullet, a year. The recycled content of the bottles produced at that company's plant is approximately 30 percent. Recycling glass conserves energy, keeps material out of the landfill, and saves resources. For example, 100 tons of cullet will yield 100 tons of bottles. However, if only virgin materials are used, there is a 15 percent fusion loss. A separate strategy of reducing weights of certain-sized bottles has yielded an annual savings of 72 million pounds of glass.

**Packaging.** Coors has followed a three-pronged strategy to improve its packaging, by reducing packaging weight, increasing recycled content, and improving recyclability. A redesign of bottle boxes has cut the amount of corrugated Coors uses by 8 million pounds annually. Most of Coors' paper packaging could not be recycled a few years ago. Today, it is 90 percent recyclable.

Two years ago, Coors entered into a nationwide agreement with a waste management firm to improve recycling performance. The partnership has improved the return Coors receives from recycled materials. The partnership team has worked on several projects, including the process for collecting and recycling office

waste paper, plastic film, and corrugated. In late 2003 Coors switched its secondary packaging to industry standard claycoat, which is more readily recycled than the metallized film coating used in the past.

**Aluminum.** Recycling aluminum saves energy and conserves natural resources. The aluminum cans Coors places in the market contain approximately 40 percent recycled content. Recycling aluminum saves 95 percent of the energy needed to produce new metal from raw materials.

### **Revenue from Byproducts Processing**

The following are several examples at Coors of the adage, "Green (in this case recycling) is good business."

**Waste beer.** Partnering with another company, Coors refines waste beer, a by-product of the brewing process, to produce 1.5 million gallons of ethanol annually. The 200-proof ethanol is blended with gasoline and sold throughout the Rocky Mountain region. A recent expansion has doubled refining capacity to three million gallons a year.

**Spent grains** are sold as cattle feed, in both wet and dried pellet forms.

**Used fermenting yeast** is dried and sold to a major pet food manufacturer for use in pet food.

**Compost.** Not all of the above by-products are suitable for further processing. Some beer that must be destroyed is combined with some spent grains, yeast, and other waste brewing materials to produce compost that is sold in bulk, primarily to commercial landscapers. In addition, damaged wooden pallets previously used in the shipping process are chipped and added to the compost stream.

**Reductions in energy use** have been realized over a number of years. One of the important reasons for this savings has been a program to sell more wet spent grain. In the past, steam was used to dry the spent grain before selling it for animal feed. By eliminating the drying process, significant energy savings were realized.

**Reductions in solid waste (trash)** have

*Coors follows various major recycling activities to achieve both environmental and bottom-line benefits.*



***A commitment to the environment is a formal part of Coors' business strategy.***

been achieved, particularly in the case of cardboard. Coors has always recycled cardboard, but a recent baling system has improved the effectiveness of that effort, and substantially cut the amount of cardboard previously sent to landfills.

### ***Bringing Suppliers on Board***

A truly effective environmental program must include all members of the supply chain. To this end, Coors works with suppliers to help them improve their environmental performance. For example, Coors presents its Conservation and Environmental Stewardship Grower of the Year Award to an environmentally-conscious barley grower. The top environmental grower is chosen from regional finalists in the Western U.S. states where the company contracts with barley growers. Coors considers the winning growers to be role models for conserving resources and protecting the land.

### ***Bringing Employees on Board***

All Coors employees take the company's Workplace Hazard Awareness computer-based training program. Also, employees at the plant level take environmental training more specific to their plant and job function. For example, the Golden, CO brewery requires all employees to go through wastewater minimization training. Training in waste management is also a requirement for many job functions. Awards are presented to the top plants in EHS practices. The award was given to the company's aluminum can manufacturing plant in 2003, the end manufacturing plant in 2004, and the Memphis brewery in 2005. Some of the results achieved at these plants include the following:

- A system was built to incorporate all requirements of a new air-emission permit into plant operating procedures.
- Employees adopted a road next to the plant, and clean it up four times a year.
- The plant is recycling or reusing 96 percent of the solid waste generated at the facility.

- Facility energy consumption has been reduced 13 percent, and water consumption 23 percent over the previous year.
- Employees have sponsored a canoeing river cleanup on the Wolf River in partnership with the Wolf River conservancy.

The three primary funding principles for Coors' environmental outreach are:

1. There must be a clear business connection to the company.
2. There should be a positive impact to the communities in which Coors has brewing operations (Colorado, Tennessee, and Virginia).
3. There should be an opportunity to build relationships with other organizations, such as environmental groups, regulators, legislators, and other stakeholders.

### ***A Continuing Commitment***

As a result of Coors' continuing efforts toward improving the environment, the company has won numerous awards. The following are a few examples:

- U.S. Environmental Protection Agency's Waste WiSe award for sustained leadership in incorporating waste-prevention actions into its core operations
- EPA Climate Wise Annual Partner Achievement Award for significant accomplishments in improving energy efficiency and reducing pollution
- Coalition of Northeastern Governors' Corporate Commitment Award for leadership in reducing packaging waste
- Circle of Excellence Award from the Distribution Business Management Association.

A commitment to the environment is a formal part of Coors' business strategy. The three key environmental goals of the strategy in 2006 include specific commitments to resource conservation, a targeted reduction in energy consumption and CO<sub>2</sub> emis-

sion, and a finalizing of all elements of the company's EHS management system.

In the words of President and CEO van Paasschen (see Figure 2), "At Coors, we measure our success not only in terms of our financial performance, but also in terms of our corporate citizenship. How we treat our people, our communities, and the environment is very important to us."

### ***Dell's Approach to Green Operations***

The electronic products industry has been under scrutiny with regard to how its products and processes may affect the environment. A particular focus has been on disposal of products such as computers when they reach the end of their useful life. One of the leading players in this industry, computer maker Dell, Austin, TX, has committed itself to an environmental policy of managing all stages of a product's total life cycle, from initial concept and design through manufacturing, customer ownership, and end-of-life reuse and recycling.<sup>7</sup>

According to Jake Player, senior manager of Dell's Asset Recovery Services (ARS), the company offers consumers and businesses around the globe a number of

ways to "retire" used computers in an environmentally-responsible manner. "We can help business and public institution customers with either value recovery or recycling," he says. "Value recovery includes refurbishment and resale of used computers or parts, with most of the proceeds being returned to the customer." Player notes that for equipment no longer having value, recycling is the usual answer, and to this end Dell helps customers perform environmentally responsible recycling of outdated or non-functional products and parts.

### ***Total Life Cycle Management***

Dell believes that each phase of the life of a product, from design to disposal, must be managed with an eye toward eliminating or minimizing impact on the environment. The basic elements of the total life cycle management program are as follows:

*Product design.* Efficient product recycling and reuse can be factored into the product at the beginning of the design stage. For example, ease of disassembly and recyclability can be designed into the product. The use of hazardous materials can be avoided or minimized by selecting alternative materials, whenever possible, that do not create a disposal problem later on. To this end, Dell has established a Design for the Environment (DfE) program that evaluates and minimizes environmental consequences of actions taken in each phase of the product life cycle, starting with supplier management through to end-of-life reuse or disposal. In addition to material selection, the amount of materials to be used is minimized. Power consumption of the product is another factor considered at this stage.

A new EU directive, RoHS (restriction on the use of hazardous substances), will come into effect this year and will restrict the use of several substances in products sold into the EU. Dell plans to comply with the requirements of the directive globally. It also follows a chemical-use policy that includes a commitment to prohibit the use of all brominated flame retardants in its products. In addition, Dell is in compliance



**Figure 2.** "How we treat our people, our communities, and the environment is very important to us."  
*Frits van Paasschen, President and CEO,  
Coors Brewing Company*

**Product recovery processes are managed and governed carefully by Dell.**

with the EU directive on waste from electrical and electronic equipment (WEEE), which sets criteria for collection, treatment, recycling, and recovery. Dell is also working on compliance with various national laws as they are developed by individual EU member countries to satisfy the directive.

**Manufacturing.** Dell manufacturing plants have achieved ISO 14001 Environmental Management Systems (EMS) certification (see the section, "Environmental Management System"). As part of this ISO initiative, each location has established goals to improve environmental performance. Improvements are tracked each quarter and progress is reported and discussed at the highest corporate levels. Continuous improvement procedures are followed and shared throughout the company.

Dell makes all products to order. It maintains only three days of inventory for most parts and equipment, thereby minimizing the environmental impact of warehousing. Components and parts are ordered and shipped to Dell on a just-in-time (JIT) basis for final assembly, thus minimizing energy and inventory costs.

The company follows a reduce, reuse, and recycle (R3) policy. All plants have permanent recycling operations that have resulted in major waste reductions. For example, the Dell sites collect more than ten different materials, including cardboard, office paper, plastics, foams, metals, batteries, disks, and pallets. This initiative annually achieves recycling and reuse of about 77,000 tons of material, diverting over 80 percent of non-hazardous solid wastes away from landfills.

**Packaging.** One goal of Dell's packaging engineers is reducing the amount of overall packaging materials, while still providing the desired level of product protection. Also, Dell tries to improve how it receives materials, and how it ships products to customers. Last year, the company switched to the use of slipsheets instead of pallets for receiving computer chassis and monitors into its facilities. Using slipsheets enables Dell to move more products in each shipping container, so fewer containers need to be used overall. As a result, use

of wood has gone down significantly. In the most recent fiscal year, the use of wood was reduced by over 10,000 tons. The company has set a goal of avoiding the use of 43,000 tons of product packaging and shipping materials between 2003 and 2007. Dell plans to meet this goal through box eliminations, use of slipsheets, and use of alternative materials in its servers, notebooks, and desktops.

**Supply chain collaboration.** Dell makes most of its components, and many of its products, through partnerships with global suppliers. In so doing, the company requires that suppliers meet its environmental requirements, and also encourages them to integrate environmental management systems into their own operations. In fact, Dell requires its Tier 1 suppliers to be certified in ISO 14001, the primary international standard for environmental management systems, and the OHSAS 18001 program that provides the standard for occupational health and safety management systems.

For the past three years, Dell has held annual environmental webcast "summits" with suppliers. Content of the summits includes the company's supplier code of conduct, product recycling strategies, energy-efficient product designs, and management of restricted materials and chemicals.

Product recovery processes are managed and governed carefully by Dell. The company prohibits its product recovery partners from exporting or landfilling waste from computer recycling projects, and conducts regular audits to ensure that all disposal streams are tracked.

**Consumer product reuse or recycling.** Dell views its relationships with consumer customers to be a continuum, from acquisition to end-of-life solutions. Various options are available when the primary use of a computer has ended. They are as follows:

- **Donation.** Through Dell's partnership with the National Cristina Foundation, consumers can donate used equipment to charity for a possible tax deduction. The non-profit foundation makes used, functional technology available to disadvantaged children and adults.

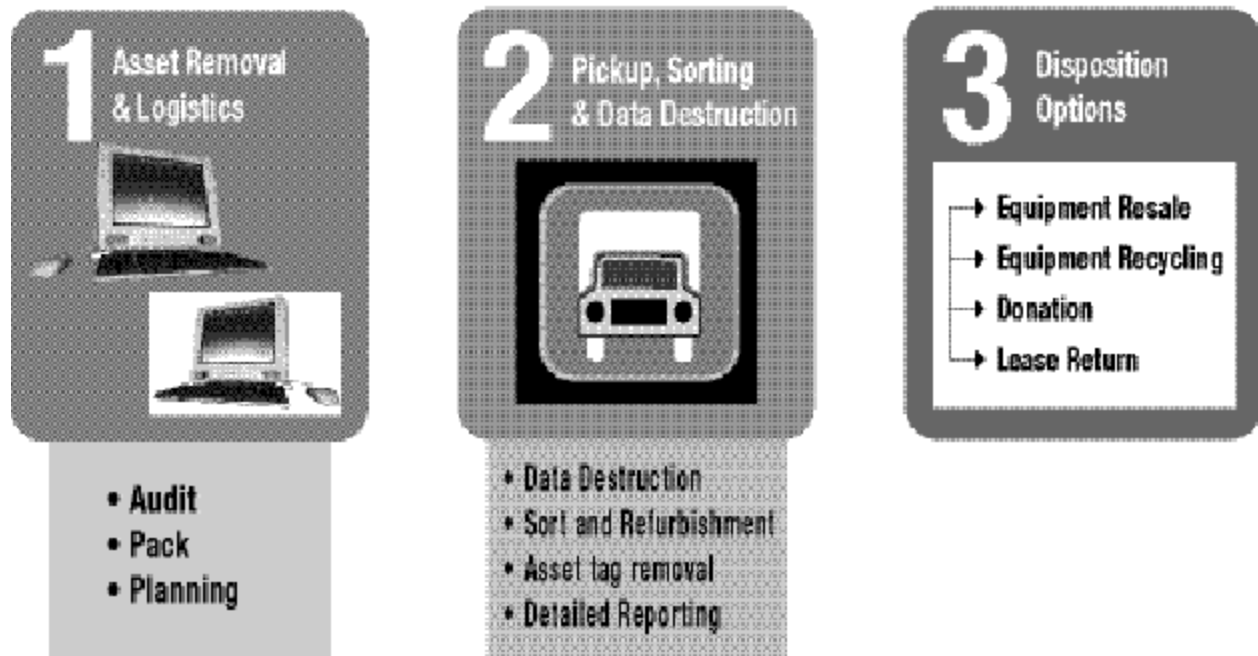


- **Recycling.** For outdated or no longer functional computers, Dell provides an environmentally-friendly recycling program in which consumers can participate. The company will accept and pick up any brand of computer, key board, mouse, monitor, or printer from the consumer's home, for a \$10 fee, or free of charge with the purchase of a new Dell computer. The company will then work with its technology partners to recycle as much of the materials and component parts as is feasible. Another option users may choose to pursue is resale.

**Business and institution reuse and recycling.** In today's world of growing environmental awareness, dealing with "end-of-life" technology can require as much thought and planning as its initial acquisition and ongoing support (see Figure 3). Dell's ARS unit was developed to make the job easier for business and institutional clients.

According to Jake Player, head of ARS, the services help customers sell, recycle, donate, or complete lease returns of their used computer equipment, including desktop units, notebooks, servers, monitors, printers, batteries, and computer peripher-

## Major Steps in Effective Asset Recovery & Recycling



**Figure 3.** Dealing with "end of life" technology can require as much thought and planning as initial equipment acquisition and support. Especially important is data security, whereby tags and labels are removed, and hard drives overwritten. *Courtesy of Dell*

**During 2005, Dell increased the amount of material recovered from consumers by 72 percent over the previous year, beating a company goal for a 50 percent increase.**

als such as keyboards. The services provide: 1) data security, whereby tags and labels are removed, and hard drives overwritten; 2) cash returns through sale of used equipment; 3) cost savings by eliminating unnecessary storage of used equipment; 4) approved disposal following EPA guidelines; 5) logistics processes to enable recycling or resale activities; 6) single-point accountability; and 7) convenience, allowing customers to focus better on their core businesses.

### **Training Programs and Ongoing Commitment**

Dell employees and full-time contractors are given an introduction to environmental issues when they are hired. Employees working in departments or units that have potential environmental impact also receive training in the ISO 14001 environmental management system. Many are involved in setting environmental goals and working to meet them. Still others are trained in special systems related to their work, such as "Design for EHS" aimed at design and manufacturing engineers. In addition, employees are encouraged to develop local environmental projects.

Overall, the company remains focused on increasing the rate of product recovery, both through providing customers easy and affordable recovery programs, and through increasing customer awareness of the importance of responsibly retiring used computers. At the same time, Dell will continue and improve its own plant recycling programs, including the permanent recycling operations established at each manufacturing location.

During 2005, Dell increased the amount of material recovered from consumers by 72 percent over the previous

year, beating a company goal for a 50 percent increase. This effort comes from the following channels: 1) Dell recycling (recycled consumer computer products); 2) ARS (computer products recovered from businesses, governments, schools, and universities); 3) donation (computer products donated to U.S. charities through Dell recycling); and 4) recycling events (computer products dropped off at recycling events sponsored or supported by Dell).

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### **Footnotes**

1. Kulwiec, Ray, "Reverse Logistics -- The Green Approach," *On the Move*, Winter 2002, The Material Handling Industry of America, Charlotte, NC.
2. "Logistics networks for the collection and processing of used large white goods," Flapper, S.D.P., H. R. Krikke, and W. S. Vermeulen, Management Report Series 57-1998, 2001, Erasmus University, Rotterdam.
3. Krikke, H. R., "Mandatory recycling of consumer electronics in The Netherlands: a role model for Europe?," Warehouse of the Future 2001, *Distribution Business Management Association, Lancaster, PA*.
4. <http://www.dti.gov.uk/sustainability/weee/index.htm>
5. <http://www.fbk.eur.nl/OZ/REVLOG/Introduction/Content.htm>
6. [www.coors.com](http://www.coors.com)
7. [www.dell.com](http://www.dell.com)

