

Electronic

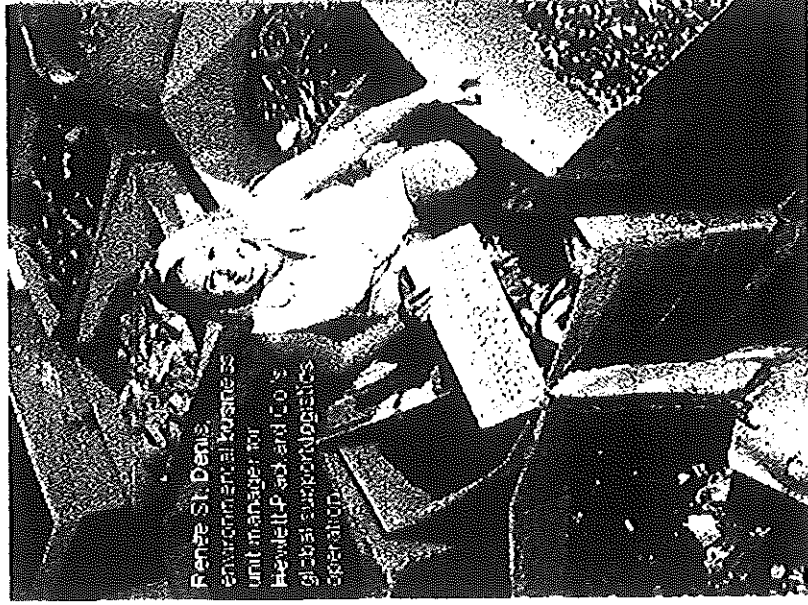
ENVIRONMENT

Ready for recycling?

Profitable or not, recycling may soon be forced on electronics makers by concerned legislators

By Russ Arensman, photography by David Toerge

Two years ago, not long after starting one of the world's largest electronics-recycling operations, in Roseville, CA, Hewlett-Packard Co.'s Renee St. Denis worried that perhaps the company had built too much capacity, too soon. Today, however, the recycling plant is operating at near full capacity, and she's considering where the company will expand next. "Now, I'd say we didn't build enough," says St. Denis, environmental business unit manager for HP's global support logistics operation.



Renee St. Denis, environmental business unit manager for Hewlett-Packard and CO's global support logistics operation.

Each month, HP's Roseville recycling program processes close to 4 million pounds of

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assorted computers, printers, circuit boards and other technology-industry refuse. Workers go through the materials first to salvage any usable parts, such as disk drives, memory chips and working monitors. Typically, says St. Denis, about half the material, measured by weight, is reclaimed and re-sold. The other half goes into a series of huge machines for shredding, sorting and separating.

The materials processing is handled by **Micro Metallica Corp.**, the San Jose, CA-based U.S. subsidiary of Canadian mining company **Noranda Inc.** Micro Metallica has invested more than \$3 million in the Roseville plant's one-of-a-kind processing equipment, which shreds electronics scrap into bits no larger than quarters, then separates it into different materials using screens, magnets and other techniques. The resulting material emerges from the other end of the plant as streams of steel, aluminum, plastic, copper and various precious metals, most of which is trucked to Noranda's smelters in Canada for further purification. "What we can't find a way to resell, we recycle," says St. Denis. She is especially proud of the fact that "nothing goes into a landfill." She describes the overall recycling effort as "a huge success."

But there are a few nagging problems. For one, HP's recycling effort is aimed almost exclusively at products collected from its commercial customers, who tend to replace equipment frequently, when it still has relatively high resale or salvage value. The company would need a much larger, and more costly program to recycle the consumer products that make up a growing portion of its business.

Secondly, St. Denis concedes the recycling operation is unprofitable, although she declines to say how much of a subsidy it requires. Most of the losses are because of the high cost of shipping waste plastics, PC monitors and other items containing cathode-ray tubes (CRTs) to Noranda's Canadian smelters. There, the CRTs are crushed and smelted to recover their lead content, while the plastic is burned for fuel.



"What we can't find a way to resell, we recycle—Nothing goes into a landfill."
—Renee St. Denis, environmental business unit manager for Hewlett-Packard Co.'s global support logistics operation

Ideally, she would like to see the plastics recycled into other plastic products, and the CRT glass reclaimed for making new CRTs. Both are theoretically feasible, but for a variety of technical and regulatory reasons it remains cheaper, at least for now, to simply burn the plastic and smelt the glass for lead removal. "If you could figure out a way around those two things you'd have a more viable business model," she says.

No one yet has figured out how to turn a profit on the entire process of electronics recycling, especially when collection and transport costs are included. Industry officials disagree about whether anyone ever will. The good news, though, is that service companies like Micro Metallica that charge fees for recycling are becoming much more efficient and cost-effective.

Meanwhile, new technologies are improving the economics of plastics and CRT recycling (see *Business Trends* story on MBA Polymers). And HP and a handful of other recycling pioneers—such as **IBM Corp.**, **Compaq Computer Corp.**, **Sony Corp.** and **Xerox**

Corp.—are making impressive progress in finding ways to reclaim and re-use their products at the end of their useful lives.

Yet despite years of research and investment, all their recycling efforts combined are barely making a dent in the amount of electronics waste piling up in landfills. As a result, governments, particularly in Europe, are adopting or considering a range of new “extended producer responsibility” laws to compel electronics makers to share all or part of the cost of recycling their products when users no longer want them.

SOURCES OF LEAD IN U.S. MUNICIPAL SOLID WASTE

estimated for the year 2000

The EPA estimates that this year there will be 281,000 tons of lead disposed of in U.S. municipal solid waste. Roughly 64% of that lead is from lead-acid batteries. Another 30% of the total is from other electronic products.

Lead-acid batteries	64%	182,000 tons
Other electronic products	30%	93,570 tons
Other lead-containing wastes*	6%	16,860 tons

* Includes glass, ceramics, plastics and other lead-containing products.

SOURCE: U.S. ENVIRONMENTAL PROTECTION AGENCY

Several states, including Massachusetts and New Hampshire, have enacted laws regulating the disposal of potentially hazardous substances such as lead, cadmium and mercury, which are currently used in many electronics devices.

Clearly, the days of being able to ignore or minimize the issue are drawing to a close. If electronics makers don't expand their own voluntary recycling initiatives soon, they will almost certainly face a host of potentially more restrictive directives from government regulators. Tony Hainault, a policy analyst with the business assistance unit of Minnesota's Office of Environmental Assistance, states the prospect succinctly: “We want electronics waste out of our garbage, and we don't want government to be solely responsible for getting it out. Companies can either choose to work with us or they can wait for us to tell them what we want done.”

A growing problem

The U.S. Environmental Protection Agency (EPA) estimates that electronics waste accounts for about 1% of the nation's 210 million tons of solid waste each year. It cites European studies that estimate that the volume of electronics waste—including old TVs, PCs, printers and other aging high-tech scrap—is growing 3% to 5% a year, almost three times faster than the overall municipal waste stream in Europe, which is estimated to be growing at 1% to 2% a year. Very little of electronics refuse, particularly from consumers, is being recycled. The National Safety Council (NSC) reported last year, for instance, that only 11% of discarded computers were being recycled, compared with about 28% of overall municipal solid waste.

“You can see why this is going to be a big issue over the next few years,” says Gordon Hui, a program analyst with the EPA's office of solid waste. “It's a small portion of the waste stream now, but it's going to be a tremendous, growing portion of the waste stream in the next couple of years.” A particular concern, he says, is the prospect of millions of old TVs being discarded if and when the long-awaited shift to high-definition TV occurs.

Adding to the problem is the increasing pace of technological change, driven by falling

chip costs, which is fueling an unprecedented spurt of new products, with ever-shorter lifespans. According to the NSC, the average lifespan of a PC, which was 4.5 years in 1992, will be just 2 years in 2005. "We have more planned obsolescence than at any other time in history," says Ted Smith, executive director of the San Jose, CA-based Silicon Valley Toxics Coalition. The coalition, through its "Clean Computer Campaign," has been one of the most vocal groups calling for PC makers to take back and recycle their end-of-life products and to ensure that all new products are upgradeable and non-toxic.

For now, however, electronics waste contains an array of toxic substances, albeit in small amounts, some of which can escape into the air or groundwater if disposal is not handled properly. According to the EPA, electronics waste is the largest single contributor of heavy metals, aside from automotive lead-acid batteries, to the U.S. waste stream (see chart). An estimated one-third of the lead in municipal solid waste in the year 2000 will be attributable to electronics other than lead-acid batteries.



"The ultimate goal is we'll get the cost down to zero within the next five years."

—Mark Small, vice president of corporate environmental affairs, Sony Electronics Inc.

Among the potentially risky materials:

- lead, used for radiation shielding in CRTs and for solder;
- cadmium, used in batteries;
- antimony, used as a flame retardant, chip encapsulant and as a melting agent in CRT glass;
- beryllium, used in connectors in cell phones and on older PCs;
- chromium, used in metal plating operations;
- mercury, used in very small amounts in the bulbs that light flat-screen displays.

European directives

Electronics companies are making a concerted effort to use fewer potential toxins. They have stopped using beryllium in motherboards, replaced arsenic with less-hazardous sodium antimony in CRT glass, substituted benign zinc sulfide for cadmium sulfide in phosphorescent CRT coatings, reduced the use of flame retardants and are rapidly shifting from toxic nickel-cadmium batteries to harmless lithium ion varieties.

But progress isn't coming fast enough for many governments and environmentalists. In June, the European Commission approved the latest draft of the long-debated European Directive on Waste Electrical and Electronic Equipment (WEEE), which would require makers of electronic and electrical goods to pay for collecting, recycling and disposing of waste equipment. A separate directive, originally part of WEEE and now proceeding in

tandem with the recycling legislation, calls for the phase-out of numerous hazardous substances from European electronics products by 2008. Although the directives still require approval by the European parliament and Council of Ministers, both are expected to become law by 2002.

The American Electronics Association (AEA) and the Electronic Industries Alliance (EIA) are closely following the progress of the WEEE directives and are lobbying, with some success, to reduce their potential effects on industry. The latest WEEE draft, for example, was modified to give manufacturers a 5-year grace period before having to begin paying for the recycling of waste equipment. Also, recycling targets for computer equipment were reduced from 90% to 65% and those for audio and video equipment were reduced from 70% to 50%.

Still, industry groups are concerned. "You can't imagine what an incredible impact this will have," says Jennifer Guhl, director of international trade policy for Washington, DC-based AEA. Her biggest worry is the phase-out of lead, mercury, cadmium and other hazardous materials, which she calls "a very, very blunt instrument."

Says Guhl: "Nobody's out here trying to defend lead. Our companies are investing millions of dollars to look into alternatives—but it can be managed." She concedes that the draft WEEE legislation allows exemptions for the continued use of lead for shielding in CRTs, medical equipment and a few other uses. But she worries that the exemption process is vague, and "rife with potential for discrimination and delay."

Holly Evans, director of environmental affairs for the Arlington, VA-based EIA, which represents 2,400 U.S. electronics manufacturers, says the WEEE directives have wide European support and are likely to be adopted. Her concern is that they allow individual European countries to adopt even more stringent recycling and substance-ban measures, which could complicate the industry's efforts to develop a unified, regional recycling plan. "When you're trying to develop a market or system for collecting recycled goods, sometimes that's not the best approach," she says.

Already, the Netherlands, Sweden and Switzerland have adopted varying recycling mandates and regulations for the disposal of hazardous substances. In Asia, Japan and Taiwan both have passed laws requiring electronics makers to take back and recycle computers, TVs, refrigerators, washing machines and air conditioners. Taiwan's law has been in effect since 1998, while Japan's takes effect in April 2001.

State initiatives

The U.S. government has steered clear, thus far, of entering the recycling regulation fray, and no new federal mandates are expected anytime soon. But several states have passed laws restricting electronics waste disposal. Others have tried, but failed, to adopt laws requiring the collection of advance fees to pay for the eventual recycling of discarded computers and TV sets. In June, New Hampshire became the first state to ban products containing mercury. Starting January 1, 2001, it has banned the sale of mercury-containing products and restricted how existing products may be disposed. Several other states have also proposed or implemented similar legislation.



"Until you start recycling, everything you throw away is waste, and that's dollars off the bottom line." —Diana Bendz, director of environmentally conscious products, IBM Corp.

Massachusetts has probably been the most aggressive state in regulating the disposal and recycling of electronics waste. Since April, it has been illegal there to dispose of any CRTs in incinerators or landfills. To its credit, the state didn't simply dump the problem in the lap of industry and local governments. Before implementing the new law, it set up six centers to collect discarded CRTs and other electronic equipment and awarded bids to two companies to recycle the material collected. It also loosened restrictions on crushing and transporting CRT glass, which the EPA classifies as hazardous waste.

"We wanted to make sure we wouldn't just hand down a decree and leave municipalities in a lurch," says Brooke Nash, chief of the Massachusetts Department of Environmental Protection's municipal waste reduction branch. She says close to one-third of the material collected is re-sold or donated to charities and thrift stores, while the state pays for the rest to be recycled.

Last year Massachusetts spent \$200,000 to support its electronics recycling program. The cost will increase significantly this year, following the ban on CRT disposal. "We saw a dramatic increase in the amount of material coming in after the [CRT] ban took effect," says Nash.

On the other hand, increased competition among recyclers, and the development of a larger market for recycled materials has driven down the subsidy paid to recyclers from 25 cents a pound a few years ago to about 10 cents a pound. "They've figured out how to process it more efficiently," she says.

Minnesota, another leader in electronics recycling, has conducted several pilot studies on the costs and likely results of residential electronics waste collection. Hennepin County, which includes the Minneapolis metropolitan area, has been recycling electronics waste since 1992 in an effort to reduce the heavy metals in its solid-waste incineration system.

Shared responsibility

In October, **Sony Electronics Inc.**, a Park Ridge, NJ-based unit of Sony Corp., selected the state to launch the country's first electronics "take-back" program in cooperation with Houston-based **Waste Management Inc.** "Our slogan is going to be 'We make it, we take it,'" says Mark Small, Sony's San Diego-based vice president of corporate environmental affairs. "It's an acceptance that we as a company have a shared responsibility."

Sony hopes other manufacturers will agree to pay for the recycling of their own products. If enough do, Small says, the resulting economies of scale should reduce, and perhaps even eliminate, the manufacturers' subsidy. "The ultimate goal is to reduce the cost to zero within the next five years," he says. Sony also intends to leave the actual recycling to Waste Management. "They don't manufacture TVs, and we don't recycle waste," says Small.

Based on earlier studies, he believes Sony can finance the collection and recycling of its own products for about 8 cents a pound. That's well below the 25 cents a pound the company expects to spend next year in Japan, under that country's mandatory take-back program. If the Minnesota program goes well, Small says, Sony intends to expand it to at least one more state this year, and nationwide within five years.

IBM, which operates the world's largest electronics recycling plant in Endicott, NY, has a task force looking at the possibility of a take-back program for its consumer products. Already, it recycles close to 90% of its mainframe and mid-range computer products at the highly automated Endicott facility. Last year, the operation processed 40 million pounds of aging electronics, much of which was salvaged as parts for sale or re-use.

"We're coming to the point where it's almost a break-even thing," says Diana Bendz, IBM's director of environmentally conscious products, who oversees the Endicott operation. Like Sony's Small, she thinks electronics recycling may eventually pay for itself, but only after systems are in place to collect and recycle huge quantities of used equipment. "It's a volume issue to some extent," she says.

Bendz, one of the industry's most experienced recycling hands, offers the following advice for companies just getting started: "The earlier they consider this a business requirement, the more profitable it'll be to them in the end," she says. "Until you start recycling, everything you throw away is waste, and that's dollars off the bottom line."

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1