Setting the Record Straight: Busting Common Myths about Plastics from Recovered Consumer Electronics
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Introduction
As more information becomes available about responsibly managing end-of-life electronics, a great deal of misinformation is also making its way into the mainstream. For example, many people claim that plastics from discarded televisions and computer monitors cannot be recycled. Yet the reality is that plastics from end-of-life electronic products can be—and are being—collected, sorted, and reprocessed into new and useful consumer goods.

The American Plastics Council (APC) has written this paper in an effort to help dispel ten of the most commonly held myths—like the one just described—that are beginning to proliferate. In place of the misinformation, it provides research results that paint a more accurate and up-to-date picture of the recovery and reuse of plastics from end-of-life electronics.

Myth Number 1: Plastics are the most prevalent material in end-of-life electronics.
Not true. A recent study conducted by the Swiss Association for Information, Communication, and Organization Technology (SWICO) found that plastics comprise only 17 percent—or about one-fifth—of the materials from end-of-life electronics. This is nearly identical to what the Association of Plastics Manufacturers in Europe (APME) found in its own study. Steel and glass from cathode ray tubes typically comprise about 30 and 20 percent respectively.) These two studies are believed to be representative of what we would expect to find in the U.S. Therefore, while plastics may appear to be the dominant material in end-of-life electronics, they are not.

Myth Number 2: There are too many different types of plastics in end-of-life electronics to be recycled.
Not according to recent research. A report published by the APME found there were only twelve types of plastic in all the electrical and electronic products analyzed. Findings were similar in the U.S. where a study conducted by the Minnesota Office of Environmental Assistance (MOEA) found only eight types of plastic in consumer end-of-life electronics.

That is not to say there are no variations among plastic grades or that additives are not used to give some plastics special properties, which can make recycling more complex. But even taking...
that into account, plastics recyclers contend that the number of plastics found in end-of-life electronics is not an insurmountable barrier to recycling.

**Myth Number 3: Technology is not available to identify and separate the plastics found in end-of-life electronics.** False. Research to develop and test equipment for identifying and separating plastics from end-of-life durable goods has been underway for more than a decade—well before managing end-of-life electronics became a prominent issue. Such research—much of which was conducted by the APC in partnership with MBA Polymers—has resulted in commercially available recycling equipment that (1) accurately detects more than 20 kinds of plastics found in durable goods, (2) identifies various additives that may be present, and (3) separates end-of-life electronic plastics into single generic streams.

Furthermore, technology is in use that enables plastics recyclers to separate plastics with flame retardants (FRs) from those without. This differentiation is already taking place: It is estimated that 30 percent of some new photocopiers contain recycled plastic with FRs—material that was intentionally specified by the manufacturer so that new FRs would not be needed.

**Myth Number 4: Plastics from end-of-life electronics have little or no value.** Not true. Clearly, one of the on-going challenges of recycling any material involves the value-to-recovery-cost ratio—or determining whether the material itself has enough intrinsic value to make the cost of processing and marketing it economically worthwhile.

Given that some electronic products are already being collected—primarily to divert potentially hazardous materials from the waste stream but more and more to recycle the scrap derived from them—the answer to that question appears to be “yes” for some, if not all, end-of-life electronic plastics. That is because the plastics used in electronic products are “engineering thermoplastics,” which have high intrinsic value. When pelletized, these plastics typically sell for a dollar-per-pound as opposed to cents-per-pound for bottle and container-grade plastics, thereby making recovery more economically viable.

The same may also be true of scrap plastics. During the MOEA project mentioned earlier, Waste Management Asset Recovery Group found that, after collection, scrap plastics from end-of-life electronics generated positive revenue regardless of how they were marketed. Plastics even generated positive revenue when the cost of landfilling mixed wood and plastic waste was taken into account.

**Myth Number 5: There are no markets for plastics from end-of-life electronics.** Wrong. Markets for plastics from end-of-life electronics have been evolving slowly. That does not mean, however, that no progress has been made. When the APC published its last report on recycling plastics from end-of-life electronics in 2000, plastics were being used primarily in lumber, outdoor furniture, and roadbed materials. Now, in addition to those relatively established applications, it is being used in camera casings, battery boxes, compact disc trays, hot mix asphalt concrete, and high quality pellets for use in molded plastics parts.

While it would be inaccurate to imply that markets for plastics from electronics are plentiful and/or widespread, it is fair to say that the groundwork is being laid to make sure that once end-of-life electronic plastics are collected on a more consistent basis—and with quality control in mind—markets should develop accordingly.
Myth Number 6: Plastics from end-of-life electronics can only be used in low-end applications. On the contrary. It is true that much of the plastics recovered from end-of-life electronics today is going into applications that have relatively lenient performance requirements. That is not, however, a function of the plastic. Instead, it is a function of not having (1) adequate performance information, (2) sufficient supplies for testing and (3) manufacturers who are willing to use the material without more performance data. That, however, is starting to change.

Following are some of the research projects that have been completed since 2000 or are still underway.

- The Gordon Institute at Tufts University worked with the plastics supply chain to identify products that could potentially use engineering thermoplastics from recovered end-of-life electronics. That work resulted in a list of 30 products that are now considered to be viable end-markets.

- The MOEA and its project partners found that HIPS from recovered consumer electronics was comparable to virgin plastic in some important ways, meaning it could potentially be used in similar applications as virgin HIPS given a consistent quantity and quality of supply.

- Studies are being undertaken at West Virginia University to determine the characteristics of thermoplastics from recycled electronic shredder residue. The goal of these studies is to identify additional, higher-end applications for recycled plastics from durable goods.

- The Gordon Institute, along with its project partners, prepared “Electronic Engineering Thermoplastics Recycled Materials Guidelines.” These guidelines were designed to help develop a common language and grading system for recovered plastics from end-of-life electronics. That, in turn, should facilitate the marketing of plastics.

- Region 5 of the U.S. Environmental Protection Agency is working to determine how much plastic Sony Electronics, Inc., would need to meet its production demand for recycled engineering plastics. It also will determine how much send-of-life electronic plastics must be collected from the region to meet that demand.

- Tufts University worked with plastics recycling companies and IBM to demonstrate the performance capabilities of HIPS from recovered electronics. That research—like APC’s and the MOEA’s—found that recycled HIPS could, in fact, be used in the manufacture of some higher-end consumer electronic products at no extra cost to the manufacturer.
These and other ongoing research and development initiatives are (1) further substantiating the economic and functional viability of recycling electronic plastics and (2) broadening the markets into which recovered plastics can go as supplies increase.

**Myth Number 7: Exporting end-of-life electronics is always irresponsible.** Not at all. In today’s world, the global economy depends upon trade, including the import and export of scrap materials for recycling. In recent years, the import and export of end-of-life electronics and the scrap derived from them has grown as a component of world trade. In the vast majority of cases, these products and the resulting scrap are managed responsibly with an eye toward using them in the manufacture of new goods.

There is, however, mounting evidence that in some instances, some products containing hazardous materials—such as lead, cadmium, and mercury—are being mismanaged, particularly in developing countries.\(^7\) The open burning of electronic parts to retrieve metals, as an example, has been documented in parts of Asia. This practice should be ended voluntarily or by regulation if necessary. It is inappropriate for end-of-life electronics containing plastics, or any organic materials for that matter, to be managed in this fashion.

That said, it is important to remember that plastics themselves are not inherently hazardous nor are scrap plastics regulated as hazardous waste under the Basel Convention.\(^8\) When scrap plastics are purchased for recycling by responsible parties, their destiny after processing is new products, not open burning.

**Myth Number 8: There are significant environmental risks associated with the use of flame retardants in electronic products.** Again, untrue. In recent years, concerns have grown about flame retardants (FRs) and their potential impact on the environment. These concerns—which have really centered on a few FRs—have caused many people to assume that (1) all plastics in electronics contain FRs, and (2) all FRs pose a significant environmental risk. Neither of these assumptions is correct.

First, a recent study published by the APME found that less than half of plastics in electronics are treated with FRs.\(^9\) They are found in some housings and in connection cables and printed wire boards. They also are found mostly in products that are exposed to high internal heat, as required by the U.S. government. They are not, however, used in the majority of plastics and certainly not all of them.

Second, concerns about the environmental impact of FRs have really centered on just one family of FRs—those containing bromine or Brominated Flame Retardants.

Within that family—which itself includes many different substances—only two are commonly used in electronic products today: deca-brominated diphenyl ether (deca-BDE) and tetrabromobisphenol-A (TBBPA). Both of these BFRs—which provide an exceptional level of
fire safety—have been investigated in the U.S. and found to present minimal risks to humans and the environment. Similarly, science-based risk assessments in Europe have concluded there is little concern associated with their use. Several other studies have additionally demonstrated that plastics containing deca-BDE will not degrade and can withstand repeated melting for recycling without any loss of properties.

**Myth Number 9: Energy recovery is the favored option for managing end-of-life electronics.** Not at all. In Europe, legislation is pending that would require plastics containing halogenated flame retardants to be handled separately from all other waste electronic parts and materials. Under that scenario, energy recovery may make the most sense. Why? Because complying with the legislation would necessitate the total dismantling of everything in the waste electronics stream, including the minutest parts. Given increasing integration and miniaturization, this simply is not economically or practically feasible.

In the U.S., however, industry continues to favor an integrated approach to handling plastics from end-of-life electronics. Such an approach includes varying combinations of mechanical recycling, feedstock recycling, energy recovery, and when necessary, the safe landfilling of plastics. Numerous studies have shown that all of these options are viable for managing plastics from end-of-life electronics, even those containing BFRs.

**Myth Number 10: The plastics industry is doing little to encourage the recycling of plastics from end-of-life electronics.** On the contrary. The plastics industry supported research into the recovery of plastics from durable goods long before managing end-of-life electronics became a recognized waste management issue. In the early 1990s the APC, along with equipment manufacturers, published a guide on how to design durable goods for the environment and undertook numerous research projects to determine if and how plastics recovered from end-of-life durable goods could be identified and separated for recycling.

### Technical Publications Available From APC on Recycling Plastics from End-of-life Electronics

(To obtain copies of any of these reports, call 1—800-2-HELP-90 or visit www.plasticsresource.com.)

<table>
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<tr>
<th>Publication</th>
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<tr>
<td>An Overview of Recycling Plastics from Durable Goods: Challenges and Opportunities</td>
<td>(1999)</td>
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<tr>
<td>Evaluation of Mechanical Recycling Pre-Sorting Options for Electronic Equipment</td>
<td>(1999)</td>
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<tr>
<td>Plastics Recovery from Electrical and Electronics Durable Goods: An Applied Technology and Economic Case Study</td>
<td>(1999)</td>
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<tr>
<td>Recovery of Plastics from Municipally Collected Electrical and Electronic Goods</td>
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<td>Automated Identification and Sorting of Plastics from Different Waste Streams</td>
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In addition, through the APC, the plastics industry has (1) participated in several public/private initiatives to determine how best to collect, dismantle, and recycle end-of-life electronics; (2) funded several plastics characterization studies to determine what plastics are potentially...
available from recovered end-of-life electronics in what amount; (3) published numerous reports on the most effective and efficient ways to recover plastics from durable goods; and (4) joined in various national efforts to help develop the end-of-life electronics recovery infrastructure. The plastics industry recognizes that its products—plastics—are an integral part of modern electronics. Because of that, it fully intends to continue to help find effective ways to recover and recycle plastics from end-of-life electronic goods.

Conclusion

So where are we now in terms of recovering plastics from end-of-life electronics? Can they really be recycled? While some questions remain, the overriding evidence suggests that plastics from discarded electronics can, if fact, be recycled. The technology to process plastics is available, sound research is being conducted to provide more and better information, and the plastics supply chain is working together to ask and answer all the right questions. Like any growing industry, it will take time to put the entire infrastructure in place; but, it appears that a system for efficiently managing plastics from end-of-life electronics will be ready once larger volumes of quality material becomes available. APC, for its part, will continue to disseminate current and accurate information that will aid in the development of the recycling infrastructure, technology, and markets.

End Notes

1 The Swiss Voluntary Take Back System for Electronics,” a presentation by Peter Bomand, SWICO Environmental Commission, 2002.


iv MBA Polymers, Inc., is a research center and durables processor located in Richmond, California.


vii The report titled “Exporting Harm” by the Basel Action Network (BAN) and the Silicon Valley Toxics Coalition (SCTC), 2002, documents examples of improper management of imported end-of-life electronic products and components in developing countries.


xi For a listing and description of eleven such studies, visit www.ebfrp.org/statements/recycl_uk.html.