CRTs going down the tubes? Hardly

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Graphic: Christine Daniloff

Many people may assume that conventional television sets and computer monitors — the kind that use picture tubes (technically known as cathode ray tubes, or CRTs) rather than flat panel screens — have virtually disappeared from the market, like buggy whips and 8-track cassette tapes. But a new MIT study reports that demand for these devices is still greater than the supply of old discarded CRTs, whose glass is recycled to make new ones.

The demand comes mostly from the world's developing nations, where inexpensive TV sets using CRTs are one of the first luxury items people tend to buy as soon as they have a little bit of disposable income. CRT

television sets “are still absolutely the cheapest way to get a first TV,” says Randolph Kirchain PhD ’99, associate professor of materials science and engineering and engineering systems and co-author of the new study. “That’s an early purchase one makes as one moves up the income ladder.”

Sales of CRT television sets peaked in 2005 at about 130 million units worldwide, and declined to about 90 million last year — almost all of those in Asia and Latin America, where sales stayed roughly constant and are expected to remain so for several years. Virtually all of these CRTs are now manufactured in Asia. Sales of CRT computer monitors peaked around 2000 at about 90 million units, but have already declined to near zero.

Because the glass used in CRTs contains a substantial amount of lead — used to block X-rays produced by the tube’s cathode ray gun to keep them from posing a health risk to viewers — the old tubes can potentially pose risks to human health if simply dumped in landfills. In some places, including most European nations and Japan, they are included in a category of electronics waste that must be properly recycled, but recycling requirements in the United States and most of the rest of the world are inconsistent, or nonexistent.

As a result, the study found that in terms of recycling glass from old CRTs to make new ones, “the amount of new glass required is decreasing, but is much greater than the amount of secondary glass collected, which is increasing.” That balance, the authors found, “is sustainable for the foreseeable future.” In other words, manufacturers wanting to use the recycled glass can count on having a supply, and recyclers can count on finding a market for the old tubes, for many years to come.

Kirchain says the study was partly an attempt to develop a more general

method for analyzing the flow of materials through the whole chain of production, use and disposal or recycling. “Our interest is in understanding how to make a materials system function in a healthy manner,” he explains, “both for economic benefits, and to minimize the environmental burden. We saw this as an interesting test case,” partly because it deals with a commodity that is gradually being phased out. “We wanted to see how materials systems evolve over time.”

The biggest issue in recycling CRTs is the imbalance in the centers of supply and demand. Most of the old CRTs being disposed of are in the United States and Europe, whereas the greatest demand for the material for making new CRTs is in Asia. But because glass is a low-value commodity, “the farther you have to move it, the less likely it is that the market drives the transaction,” Kirchain says.

Fortunately, there is one other use for the recycled glass — as an additive in smelters used to produce metals. “Any kind of smelter will use silica [the main ingredient in glass] as a flux, to separate out anything in the mix they don’t want,” says Jeremy Gregory SM ’00, PhD ’04, a research scientist in MIT’s Materials Systems Laboratory and lead author of the new study, published in the December issue of the journal Environmental Science and Technology. In some smelters, he says, the operators are willing to use old CRT glass as a flux material, although they generally charge the suppliers for taking it off their hands. If the plant is producing lead, the lead-laced glass can actually add to the lead produced, although the amount is very small, he says.

In Europe, with its strict regulations requiring electronics waste recycling, CRTs represent by far the biggest category of such material being collected, though e-waste is only 1 to 2 percent of the overall waste stream. But because of its lead content, it is one that merits attention, Kirchain and Gregory say, especially since much of it gets shipped from the industrialized world to developing countries where there are fewer

regulations regarding its disposal and the protection of people exposed to it.

Ruediger Kuehr, head of the operational unit at the United Nations University's Institute for Sustainability and Peace, says that this academic study can provide important advice for both industry and government regulators because "those entities are often focused on short-term and short-sighted issues, and do not have the luxury of taking a broad systems-wide, hence holistic, view of an issue." He says this study is "quite useful in considering what should be done with all of the materials that are a byproduct from recycling, particularly when it is not clear there is demand for the recycled materials."

The study, Kirchain says, underscores the need for manufacturers to consider the full lifecycle of a product and try to plan ahead for recycling and repurposing of devices that have outlived their original function. Such issues will continue to gain urgency, he says, as new products enter the market, for example the vast number of new batteries that would be required for a major shift toward electric vehicles. "There's a lot of interest in driving the new technologies," he says, "and very little in finding something useful to do with them at the end of their life."

Provided by Massachusetts Institute of Technology

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