Importance of and Opportunities for Recycling All Electronic Equipment

Introduction

The average American has numerous electronic products such as computers, mobile phones, televisions, and e-readers. Due to the relatively short life of these electronic devices, millions of tons of consumer electronics devices are ending up in landfill every year.[1] Critical metals and minerals are found in all high-tech electronics. These rare materials are essential to the performance of electronic products we use in our everyday lives. With the increasing preference for more sustainable and environmental consumer products, recyclability has become an important requirement in their design and manufacturing.

Sustainability

Electronic devices and technologies continue to advance and increase in number. These technologies have become ubiquitous throughout society and essential for economic growth. With these technologies comes the increasing challenge of protecting human health and the environment from the potentially harmful effects associated with their disposal. A long-term sustainable approach towards electronics stewardship has become necessary going forward. Sustainable consumer electronics ultimately requires recycling.

Increasing sustainable electronics design leads to increased recyclability which can ultimately support the recycling industry. The country can increase its domestic recycling efforts which will reduce environmental issues from the exportation of our electronics waste to developing countries.

Recycling electronics can reduce pollution and energy consumption that would be generated during production and manufacture of new products.

Recycling

When consumer electronics reach their end of their life as a useful device there is still an opportunity to recover the materials from electronics to make new products.

Recycling is better than disposal because it has a greater benefit to the environment to avoid depletion of natural resources. Recycling also reduces the need for landfill space and all the deleterious effects resulting from electronics waste dumps. Environmentalists are increasingly seeking technological solutions that will lead the country to a circular economy where we recycle and reuse all the materials in consumer electronics.

There are many challenges toward implementing a successful recycling strategy from transportation, collection, preventing the inclusion of hazardous materials, and harmful methods. Unfortunately, people expect recycling to be free, funded solely by the value of the materials in the electronics. Society needs to consider the full cost of not implementing recycling. Consider the cost of waste disposal and the ever-growing landfill problem, never mind the damage done with dumping waste in the oceans. Society is paying for the deleterious effects on our health and our environment. When recycling is done properly,

[1] EPA https://www.epa.gov/facts-and-figures-about-materials-waste-and-recycling/durable-goods-product-specific-data#Electronics

it results in a circular economy where the materials from discarded electronics become the feedstock to make new products.

Stewardship

These programs are sometimes referred to as Extended Producer Responsibility (EPR). The theory is that manufacturers created these devices with hazardous materials and therefore it is their responsibility to collect and recycle them at their end of life to prevent environmental pollution. Manufacturers of new electronics are legally obligated to collect used electronics for recycling. The challenge is that products are sold to consumers around the world, and it is impractical for a manufacturer to collect their product at the end of use. Instead, they collect electronic products from other manufacturers to meet their obligations.

Recycling Processing Technology

Details of how the various waste materials are separated is described in the following three sections.

Separation Process - The electronic components are first received and sorted if there are hazardous materials (such as those contained in batteries). After the electronic equipment is received, the next step in recycling is to remove and separate hazardous materials, including batteries, toner/ink, mercury bulbs found in some scanners/printers and cathode ray tubes from monitors, which contain lead. This manual process ensures hazards are disposed in a compliant manner to provide for environmentally sound processing. Recycling sites are equipped with automated industrial shredders, conveyor systems and sorting equipment. After hazards are removed, the electronic equipment is fed by conveyor into a large shredder. The shredder tears the material into large pieces, about 2" to 6" in diameter. This first step prepares the electronic waste to begin the process of separating plastic parts from both the metals and minerals. After shredding, the conveyor belts push the electronic waste through magnets, eddy currents, infrared cameras, and air jets. These technologies work together to sort out different material types and separate sorted material from the e-waste stream. Iron and steel is first separated then the aluminum, copper, minerals and circuit boards are separated. After the valuable metals and minerals are removed, the plastic waste stream is further separated into ABS from polystyrene plastic. In the final step, the plastic is sent through an advanced metal removal process, to remove any residual metal and improve the purity of the plastic stream.

Separating Magnetic Metals- After shredding, conveyor belts transfer the shredded components under a powerful magnet, which separates the magnetic metals from the shredded e-waste. The metals are then prepared for sale as recycled commodity materials.

Separating the Valuable Metals and Minerals - After passing under the magnet, the waste continues to through additional mechanical separators. Non-ferrous metals (aluminum, copper, and circuit boards) are removed through advanced separation equipment. Visual inspection and sorting improve the quality of the extracted materials. The separated streams of aluminum, copper, and circuit boards are and prepared for sale as recycled commodity materials. The remaining waste is now primarily plastic.