

A young man with a serious expression sits in the center of a cluttered room. The room is filled with stacks of electronic waste, including old laptops, monitors, and various components. A single light bulb hangs from the ceiling, casting a dim light. The walls are green and appear worn. The overall atmosphere is one of a makeshift recycling or storage facility.

The Growing Issue of Electronic Waste

WRITTEN BY DAN ARNOLD
PHOTOGRAPHY BY CAROLINA RAPEZZI

THE GROWING ISSUE OF ELECTRONIC WASTE

Ecoprint Insights are produced by Ecoprint, a Virginia-based printing company focused on sustainable products and processes since 1978. Over the past 40 years, we've come to understand that sustainability is complicated. We are on a mission to continue learning and improving our practices, both personally and professionally. Through these reports, we are sharing what we learn with you—our customers, vendors and the general public—because we know progress requires a collective understanding of the problem.

The Growing Issue of Electronic Waste

BY DAN ARNOLD

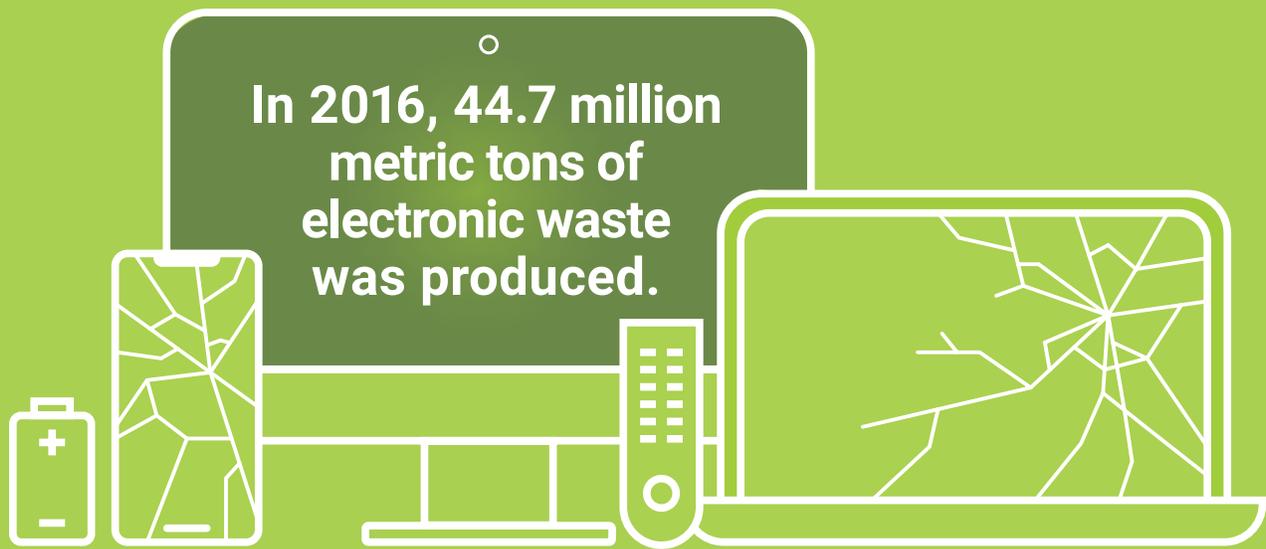
Summary

- **Electronic waste is the fastest growing stream of waste globally.** In 2016 alone, 44.7 million metric tons of electronic waste was produced, enough to fill 4,500 Eiffel Towers. This number is only expected to rise with the increase in buying as a result of planned obsolescence. People are keeping their electronics for less time as newer products are constantly being pushed out.
- **Improper disposal of e-waste leads to toxic materials leaching into the soil, water, and air.** Lead, mercury, cadmium, beryllium, PVC plastic, and hazardous flame retardants are all used to make different electronics and are harmful to both the environment and human health. When incinerated or put in landfills, these materials pollute the environment and become part of the air people breathe and food people eat.
- **Unregulated recycling of e-waste in developing countries is an ongoing humanitarian crisis.** Electronics contain valuable materials like gold and copper which manufacturers want to get back and use again in their products. It is cheaper to export e-waste to poor countries with no regulations on recycling processes than to mine the materials out of the ground. However, the workshops in developing countries have little to no safety measures, and the excess e-waste destroys local communities.
- **The US has no legislation preventing the export of e-waste.** The EU and 186 states ratified the Basel Convention, which reduces the amount of waste shipped abroad, but the United States was not part of it. They signed it but never put forth any legislation to enforce it in the country, so there is no federal law against exporting e-waste.
- **The best way to combat e-waste is for governments to regulate it, businesses to manufacture more responsibly, and consumers to hold on to their devices for longer.** Governments have to create better and more efficient recycling systems, but more importantly, they have to hold companies accountable for the damage their products are causing across the world. The manufacturers also need to take it upon themselves to produce more environmentally conscious products. Finally, individuals can change their buying habits to decrease the amount of electronics they throw out every year and make sure they are disposing of them properly with a certified recycler.

Introduction

Guiyu, China, was once known as the world's largest dumping site for electronic waste recycling. Piles of cables, monitors, circuit boards, and other scraps of electronics lined the streets as men, women, and children disassembled parts by hand. They burned pieces and boiled them in acid to recover valuable materials to resell back to manufacturers. Toxic chemicals

COVER PHOTO: Ghana, Accra. October 2018. Zakari inside his brother's repair shop in the Old Fadama slum, Agbogbloshie. His brother Youssef opened this shop 15 years ago. Zakari and Youssef buy laptops and computers in different area of the capital. If irreparable, they dismantle them to reuse the parts. Image Copyright: Carolina Rapezzi



polluted the town, damaging crops, livestock, and public health. The government has since made efforts to ban the dangerous recycling methods and clean up the town, but the effects are still lasting and the burden has simply been passed on to other countries. Agbogbloshie, Ghana, now houses one of the biggest open-air e-waste dumps in the world where fields of electronics are set on fire to recover materials. Electronic waste continues to be dumped on developing countries across the globe.

E-Waste

The UN classifies electronic waste in six categories: temperature exchange equipment, screens, lamps, large equipment, small equipment, and IT.¹ In short, e-waste is any device that has a battery, plug, or uses electricity. These products are disposed of when they lose value through redundancy, replacement, or breakage and then enter the waste stream. Electronic waste is currently the single fastest-growing stream of waste globally, with 44.7 million metric tons (Mt) produced in 2016 and a predicted 52.2

Mt by 2021.² This means that e-waste is around 2.4% of all solid waste produced globally.³ Furthermore, less developed countries have higher e-waste growth rates than more developed countries.⁴ In 2016, enough electronic waste was produced to stretch from New York to Bangkok and back and to fill 4,500 Eiffel Towers.⁵

In addition to the sheer volume of electronic waste produced, what's inside these devices is significant. Electronics contain valuable elements like gold, silver, copper, and platinum as well as toxic heavy metals like lead, mercury, cadmium, beryllium, PVC plastic, and hazardous flame retardants. The presence of precious metals creates an incentive to reclaim them from discarded devices. In 2016, an estimated \$55 billion of recoverable materials could be found in the world's e-waste.⁶ This has led to an increase in urban mining, which is the process of salvaging the valuable resources from old electronics instead of the traditional mining of elements from the ground. However, there are risks in doing so. The harmful materials can degrade the environment and have negative health effects if not handled properly.

1. Baldé, Kees, et al. "The Global E-Waste Monitor 2017." United Nations University, UNU & ITS, 2017, ewastemonitor.info/.

2. Ibid.

3. "Solid Waste Management." World Bank, 23 Sept. 2019, www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management.

4. Baldé, Kees, et al, supra note 1

5. Ibid.

6. Ibid.



Ghana, Accra. November 2018. Gafaru, 18 years old, takes a break from burning in the Kilimanjaro area in Agbogbloshie. Image Copyright: Carolina Rapezzi

Production

Mining for materials to produce electronics is a fossil fuel-dependent industry with a large carbon output. Excavating ore is invasive to the local ecosystem because it completely alters the existing landscape. When the material is broken up, dust is released that can combine with heavy metals which cause health problems. It pollutes the air and can spread to nearby areas and bodies of water. Modern mining techniques are also water-heavy, and wastewater can contain many harmful pollutants that often are not contained properly.⁷

Open-pit mining is the most common form to obtain the resources in electronics. Strategic materials are extracted by excavating large amounts of ore from a pit in the ground. However, many resources only come in small concentrations, so miners have to remove large amounts of material to find

them.⁸ This process is disruptive to the existing land and generates tons of waste material.

Lithium mining also has issues in the production of electronics. Lithium-ion batteries have largely replaced lead-acid batteries in electronics as the more energy-efficient and environmentally friendly option, but these titles are misleading. In South America, lithium is extracted by digging deep holes under salt flats and pumping water out to get a brine containing manganese, potassium, borax, and lithium. It gets evaporated and filtered over a series of months until the lithium can be extracted. This method uses 500,000 gallons of water per ton of lithium in a region known for being one of the driest in the world. There are also possibilities for toxic chemical leaks, like hydrochloric acid, from the evaporation pools. In Tagong, Tibet, lithium mine leaks have contaminated surrounding waterways. Masses of dead fish and yak

7. "Environmental Risks of Mining." *Mission 2016: Strategic Mineral Management*, MIT, 2016, web.mit.edu/12.000/www/m2016/finalwebsite/problems/mining.html.

8. Ibid.

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carcasses killed by toxic materials were found floating on the surface of the Liqi River.⁹ Yet despite these environmental issues, lithium-ion batteries continue to be the most popular choice for all new phones, laptops, and electric cars.

Cobalt, another important element used in lithium-ion batteries, is found in abundance in Central Africa. Its price has nearly quadrupled over the past few years. However, cobalt is a toxic heavy metal and child labor is often used to take cobalt out of the ground by hand and without protective equipment.¹⁰ These countries with lithium and cobalt deposits want to use the growing demand to become economically powerful like the oil-rich countries of the Middle East, so they are not concerned with using environmentally conscious methods of extraction.¹¹

Many of the materials used in electronics are not as readily available, and some manufacturers have experienced shortages. Companies have thus looked into getting the necessary metals from the growing volume of electronic waste through different forms of recycling.

Formal Recycling

Electronic waste has different ways it can be recycled properly, and in 2016, 20% of electronic waste globally was recycled correctly.¹² First, good recyclers will find used devices that can be refurbished and resold to other people or to developing countries where older operating systems and technologies have not yet become completely obsolete.¹³ If this is not possible, companies mechanically shred and separate waste

E-Waste (like cell phones, circuit boards and batteries) releases harmful chemicals when not disposed of or recycled properly. These chemicals often end up in the water people use for agriculture, livestock, and even for drinking.

into different categories and then clean it.¹⁴ Any pieces of equipment with data on them have to be securely wiped,¹⁵ and then the remaining waste gets shredded further and smelted. The valuable materials are recovered and sold back to companies.

Some companies have started their own efforts to increase recycling of their products. In 2018, Apple came out with Daisy, a robot that recycled iPhones. It could dismantle 200 phones per hour, preventing roughly 48,000 metric tons of waste from reaching landfills. However, this effort did not make a significant change, as the amount of e-waste generated in total was roughly 50 million tons that year.¹⁶

Formal electronic waste recycling is expensive, and the recyclers have to follow strict guidelines to prevent any health or environmental hazards, so companies often instead resort to other forms of recycling.

9. Katwala, Amit. "The Spiralling Environmental Cost of Our Lithium Battery Addiction." *WIRED*, WIRED UK, 3 Aug. 2018, www.wired.co.uk/article/lithium-batteries-environment-impact.

10. See e.g., <https://www.theguardian.com/global-development/2019/dec/16/apple-and-google-named-in-us-lawsuit-over-congolese-child-cobalt-mining-deaths>

11. Ibid.

12. Baldé, Kees, et al, *supra* note 1

13. Staff, NPR. "After Dump, What Happens To Electronic Waste?" *NPR*, NPR, 21 Dec. 2010, www.npr.org/2010/12/21/132204954/after-dump-what-happens-to-electronic-waste.

14. Ibid.

15. Cho, Renee. "What Can We Do About the Growing E-Waste Problem?" *State of the Planet*, Columbia University, 27 Aug. 2018, blogs.ei.columbia.edu/2018/08/27/growing-e-waste-problem/.

16. Semuels, Alana. "Electronic Waste Is Becoming a Global Environmental Problem." *Time*, Time, 23 May 2019, time.com/5594380/world-electronic-waste-problem/.

Informal Recycling

What waste is not recycled properly is largely undocumented. At least 4% of it ends up in landfills, but this reporting only comes from higher-income countries. 76% of electronic waste is not tracked and could be landfilled, exported, or recycled against guidelines.¹⁷ Informal electronic waste recycling is when countries send their e-waste to developing nations where it is unlicensed and unregulated. This approach is popular because it is less expensive to recover the valuable materials left in e-waste than other methods, such as formal recycling or mining. Excavating copper, gold, and aluminum from ore costs 13 times more than reclaiming the materials through formal e-waste recycling.¹⁸

Guiyu, China, once was the world's largest destination for e-waste before the government-sponsored cleanup efforts. Waste was piled throughout the streets as adults and children pulled apart devices to reclaim materials from the parts. They would burn circuit boards and plastic and copper wires and then wash them with hydrochloric acid to recover the metals.¹⁹ The waste that could not be used to recover valuable materials was dumped.

While Guiyu's informal recycling has since decreased, the town has not fully recovered. In addition, there are still large sites all over the world in India, Ghan, Liberia, and Nigeria.²⁰ One of the current largest e-waste dumps is a district in the capital of Ghana called Agbogbloshie. It is a completely unregulated open-air site where migrant workers burn all kinds of electronic devices. There is no protective equipment and no containment of the toxic materials, so the entire town is exposed to harmful chemicals and pollutants like lead and cadmium. Nearby

waterways are clogged with discarded waste and animals roam free across pastures of burnt electronics. The workers know it is unsafe, but most have no other option and need the money to support their families.²¹

Informal recycling processes release toxins that can lead to adverse health effects like cancer, neurological disorders, bone loss, and kidney, liver, and nervous system damage.²² There are also many childbirth issues related to these toxic materials, such as spontaneous abortions, stillbirths, premature births, reduced birth weights, mutations, and congenital malformations. The burning and washing of discarded electronics also releases gases, particulate matter, and liquid waste into the air and water which pollutes the environment.²³ Back in Guiyu, the land was so polluted that cadmium was found laced in the rice grown in the surrounding areas.²⁴ These naturally occurring heavy metals do not biodegrade, so they bioaccumulate in organisms over time. This means toxic materials can infect an entire food chain and find their way into the food people eat.

Non-Recycled

The electronic waste that is not recycled in some form is either incinerated or put in landfills. For consumers, recycling electronics is often a difficult task because people have to go to special sites instead of dropping these items in their recycling bins at home. So, e-waste often finds its way into the regular trash and eventually a landfill or an incinerator. Electronic waste contains many harmful materials such as, but not limited to, lead, mercury, and flame retardants, and they can leach through landfills into groundwater.²⁵ This means the harmful chemicals destroying e-waste sites

17. Baldé, Kees, et al, *supra* note 1

18. Cho, *supra* note 14

19. Watson, Ivan. "China: The Electronic Wastebasket of the World." *CNN*, Cable News Network, 31 May 2013, www.cnn.com/2013/05/30/world/asia/china-electronic-waste-e-waste/index.html.

20. Cho, *supra* note 14

21. Rapezzi, Carolina. "Burning Dreams." *Medium*, Witness, 6 Feb. 2020, witness.worldpressphoto.org/burning-dreams-28ded3964092.

22. Gill, Gitanjali Nain. "Electronic Waste." *Encyclopædia Britannica*, Encyclopædia Britannica, Inc., 26 May 2016, www.britannica.com/technology/electronic-waste.

23. *Ibid.*

24. Watson, *supra* note 18

25. Cho, *supra* note 14



Ghana, Accra. November 2018. Rashida, age unknown, waits to sell water to workers burning appliances and cables.
Image Copyright: Carolina Rapezzi

abroad can end up in the water people use for agriculture, livestock, and even for drinking. The contaminated groundwater also leads to streams, which harms local ecosystems and bioaccumulates up to the food people eat. Incinerating e-waste releases extremely toxic dioxins that can be deadly if exposed to.²⁶ As per the most recent data, the majority of electronic waste ends up at this stage.²⁷

Legislation

The element that makes electronic waste management difficult is the lack of data and legislation. The most recent

statistics on e-waste are from a UN report published in 2017²⁸ and a watchdog group called the Basel Action Network.²⁹ There are no governmental groups dedicated to the management of e-waste and no yearly reports exist. On the legislative side, the EU and 186 states ratified the Basel Convention, which aims to reduce the transport of hazardous waste to less developed countries, making events like those in Guiyu illegal.³⁰ However, the United States has not ratified the Basel Convention and still has recyclers transporting e-waste abroad.³¹ There are no federal rules or regulations on electronic waste, and there are only 28 states who have laws regarding it which are all different.³² With no consensus

26. Gill, *supra* note 21

27. Baldé, Kees, et al, *supra* note 1

28. *Ibid.*

29. "e-Trash Transparency Project." *Basel Action Network*, 2019, www.ban.org/trash-transparency.

30. Cho, *supra* note 14

31. *Ibid.*

32. *Ibid.*

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on regulations, tracking and reporting is sparse, and 80% of all e-waste is largely undocumented.³³ This issue is that with individual states each having different regulations on electronic waste, they do not have the market share to cause companies to change their ways and produce more environmentally conscious products.³⁴

The Uptick in E-Waste

Electronic waste is the fastest-growing stream of trash globally because of the short life span of most devices. People are buying more electronics and replacing them sooner. Every year, consumers purchase new smartphones, computers, TVs, and kitchen appliances that are all promised to be the next big thing in tech, and they dump the electronics they already had without a second thought. People are holding onto devices for less time because new products are constantly making older electronics insufficient or unusable.

Planned obsolescence is a major factor in the shortening of product lifespans. Manufacturers purposefully create new technology so that it will make their older products obsolete. They also design products so that they only last for a certain time and then need replacing. For example, new iPhones have operating systems with features that are not supported on older devices.³⁵ Most smartphone batteries cannot be easily replaced when they stop holding a charge, old cables do not plug into new laptops, and software companies push upgrades that will not run on old devices.³⁶ The average lifetime of a printer is only around five hours of actual printing time.³⁷ This privileges newer models and pressures consumers to replace their current electronics even if they are still wholly usable. There is also a social pressure that makes people feel the need to always have the newest and best technology.

33. Baldé, Kees, et al, *supra* note 1

34. Cho, *supra* note 14

35. Harris, John. "Planned Obsolescence: the Outrage of Our Electronic Waste Mountain." *The Guardian*, Guardian News and Media, 15 Apr. 2020, www.theguardian.com/technology/2020/apr/15/the-right-to-repair-planned-obsolescence-electronic-waste-mountain.

36. Semuels, *supra* note 15

37. Harris, *supra* note 34

38. Ahmed, Syed Faraz. "The Global Cost of Electronic Waste." *The Atlantic*, Atlantic Media Company, 29 Sept. 2016, www.theatlantic.com/technology/archive/2016/09/the-global-cost-of-electronic-waste/502019/.

39. Baldé, Kees, et al, *supra* note 1

The current trajectory of electronics is unsustainable. Electronic waste is the fastest-growing stream of waste, as product lifespans are shortened due to planned obsolescence, and there are few efforts worldwide to manage this issue.

Another cause of the uptick in e-waste is that it is becoming cheaper for companies to produce electronics. The use of semiconductors and the availability of cheap labor in countries like China, India, and Brazil have made it easy for manufacturers to drive down prices.³⁸ The high cost of repairing a device often makes it more economical to just purchase a brand new one when it gets damaged.

Conclusion

The current trajectory of electronics is unsustainable. Manufacturers are pumping new devices and products into the market, supporting a throwaway society. Electronic waste is the fastest-growing stream of waste, as product lifespans are shortened due to planned obsolescence, and yet there are few efforts worldwide to manage this issue. When not dealt with properly, e-waste is seriously harmful to public health and the global environment. Toxic materials end up in groundwater, soil, and the air in countries all over the world.³⁹ Companies are worried about driving costs down and putting out better products but not sustainability.

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Mobile phones are a good case study highlighting the issues with electronic waste as well as what people can do about it going forward. Phones fall under the Small IT category, which generated 3.9 Mt of all e-waste globally in 2016. In the US, China, and EU, the average life cycle of a cell phone is somewhere between 18 months to 2 years, and the amount of waste generated from phones is growing steadily. Companies have to produce devices that have longer lifespans, but consumers can also take steps to help. Using a strong case and durable screen protector to prevent cracks in the screen is effective in increasing the lifespan of a phone. The battery life can be lengthened by not charging all the way to 100 percent, dimming the brightness, and turning off bluetooth or Wi-Fi when not in use. Taking extra care of mobile phones can delay them from ending up in a landfill, incinerator, or developing country and decrease the total amount of waste generated.

To solve this problem, a group effort between legislators, producers, and consumers is needed. Governments across the globe have to regulate and track electronic waste to hold companies accountable for the damage their products are causing the world. Manufacturers and companies have to invest in responsible, formal recycling. There are recycling groups that work with offices to safely dispose of their electronics by wiping all sensitive data and recycling the materials. Partnering with recyclers can make sure companies are not adding to the growing e-waste problem while also preventing any security risks.

Finally, buyers have multiple responsibilities. Individuals should buy fewer electronics and hold on to what they have for longer; they should also purchase from companies who are investing in more environmentally conscious practices. For example, Apple invests heavily in renewable energy and responsible recycling. They not only recycle much of their own product, but research better processes for e-waste recycling.⁴⁰ Many electronics manufacturers, like Sony, Toshiba, and Tesla, now publish annual environmental reports to manage current performance and set goals for the future. Buyers are also responsible for making sure their old electronics are recycled properly. The Consumer Technology Association has a recycler lookup where people can find the closest recycler to them. Buyers have many different ways in which they can impact the e-waste problem through careful purchasing, life extension of products, responsible recycling, and more.

A collaborative group effort is required if the world wants to better manage electronic waste. No one entity can put the onus on the other. Governments cannot expect businesses to take full responsibility for the excess electronics in circulation. Consumers can not put the blame completely on corporations while not taking any individual action. The hard truth is that e-waste will not be controlled through one easy fix. It is everyone's responsibility to take action.

The Consumer Technology Association's recycler lookup is a great tool for individuals to easily find how to properly dispose of their old electronics. It includes both businesses like Best Buy and Staples as well as direct recycling companies, which all use safe formal processes. Places like Best Buy and Staples partner with certified recyclers who sort, separate, and process electronic waste in their own facilities. It is important to support businesses who offer recycling programs to keep electronics recycling alive. Visit <https://www.cta.tech/Landing-Pages/Greener-Gadgets> to look up local electronics recyclers.

40. "Apple Expands Global Recycling Programs." Apple Newsroom, Apple Inc., 18 Apr. 2019, www.apple.com/newsroom/2019/04/apple-expands-global-recycling-programs/#:~:text=As%20part%20of%20its%20Material,back%20into%20the%20manufacturing%20process.

About the Photographer

Carolina Rapezzi is a freelance photojournalist covering social, humanitarian, and environmental issues in Europe and West Africa. Carolina started working on humanitarian issues in 2015, reporting on the refugee crisis in Sicily and the eviction of the Calais refugee camp in France. Since 2016, she has been following the political protests around Brexit. Carolina is currently working on an ongoing project about gender and identity in London called "It was meant to be." Since November 2018, she has focused on environmental issues and e-waste in West Africa.

About the Author

Even as a child, Dan Arnold's outlook on life was, shall we say, sophomoric. He must have known that he would one day be entering his second year at UVA. And if his freshman year is anything to go by, he has a very bright future. When he's not researching the devastating effects of eWaste or plastics on our planet, Dan marches as a baritone in the world famous Cavalier marching band and plays principal euphonium in the UVA wind ensemble. That's not a euphemism, it's a euphonium. Dan also writes for The Declaration student newspaper, DJs at WXTJ, the student radio station, and, as a member of the Alpha Phi Omega service fraternity, helps complete strangers throughout the Charlottesville community.

You'd think he'd want a break before heading back to class this fall—in one way or another Dan will continue studying politics—but not this overachiever. Dan will be spending the rest of the summer interning at More Vang, researching and writing reports and environmental blogs for Ecoprint. We're lucky to have him.

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