Outline

I. Introduction to e-waste cycle
II. Current US policies:
    Poison or Protection
        1. Right to Repair vs. Copyright
        2. Bricking through EULA and ToS
III. Education and our Game
IV. Other avenues to explore with your students

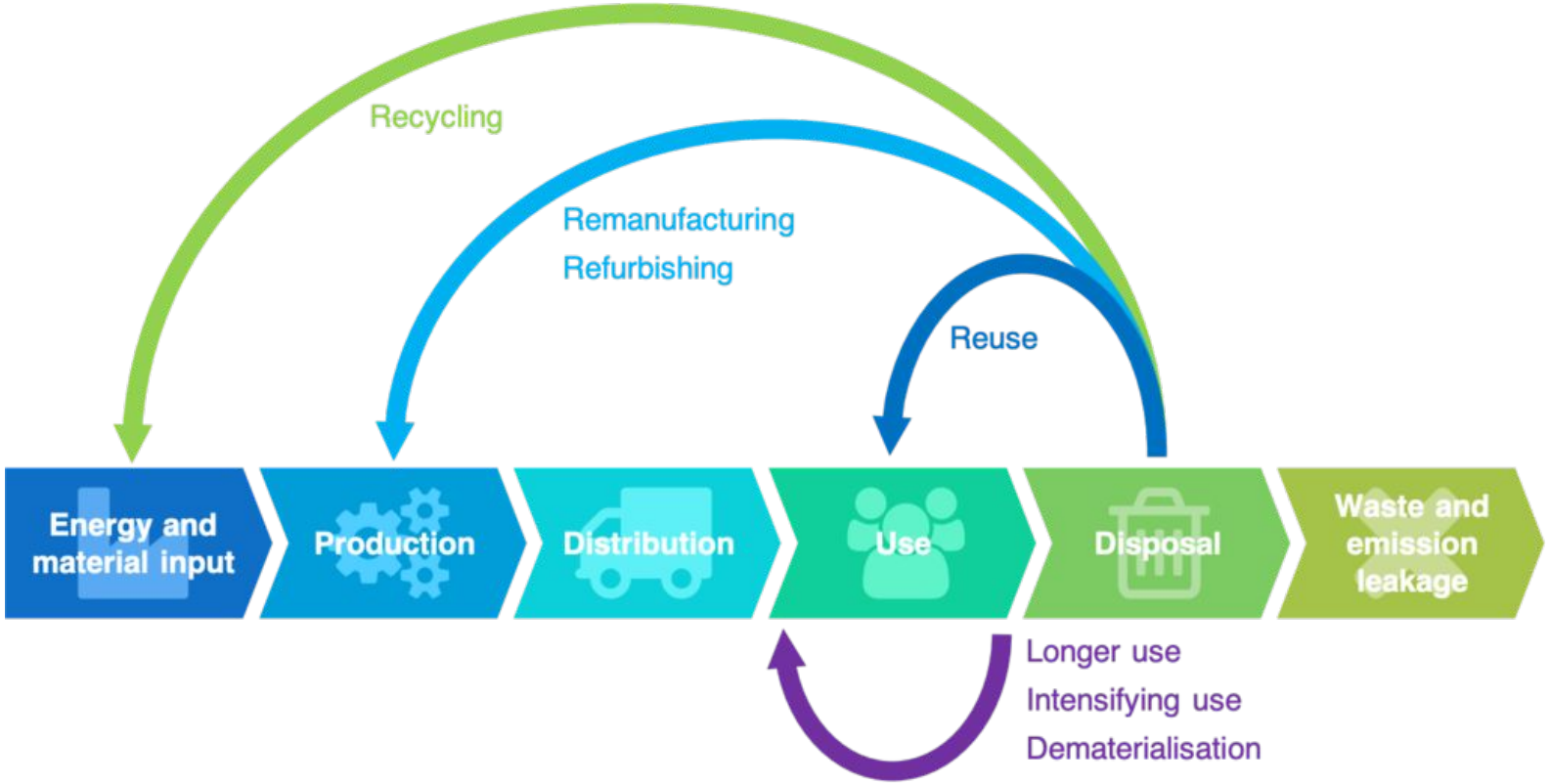
How can we break the cycle of e-waste?

What is our responsibility?

Government, Tech Companies, Businesses, You?

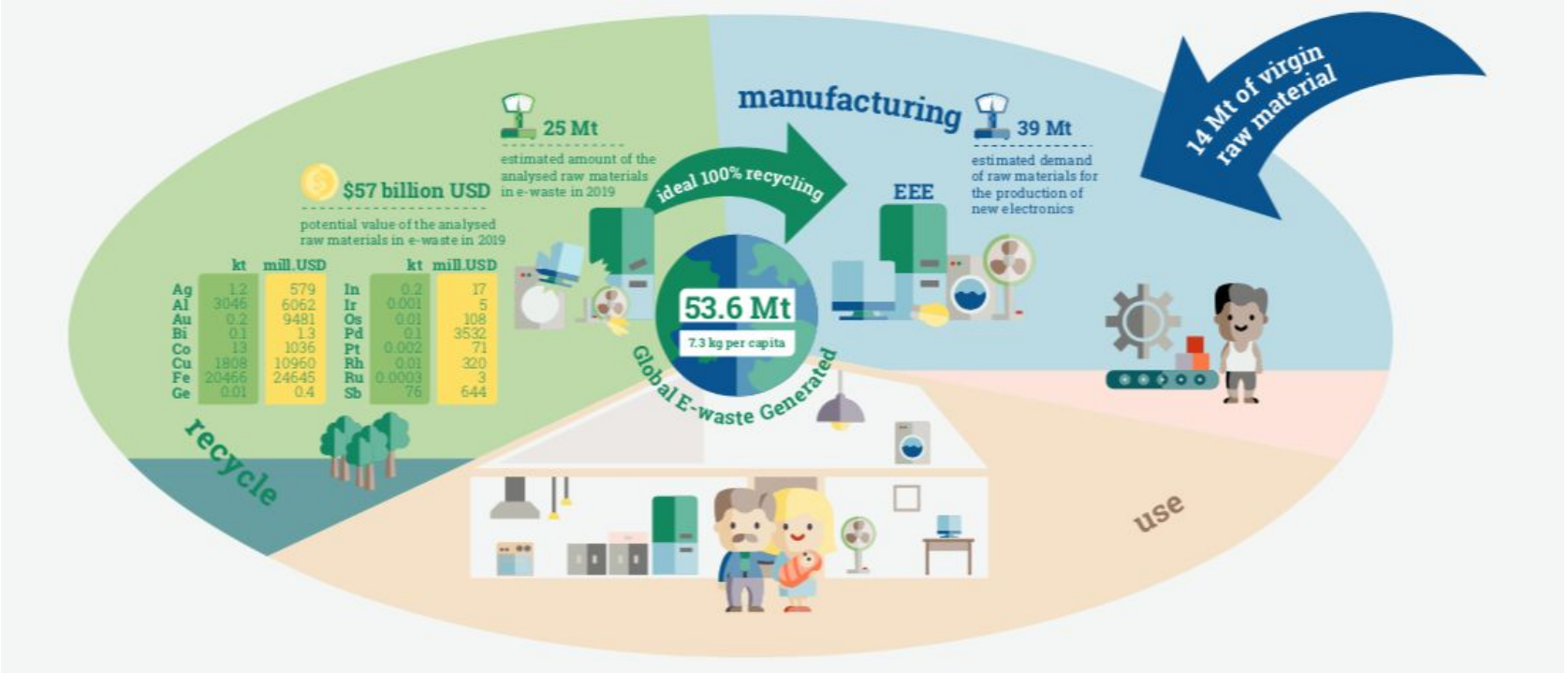
Presented by Pat and Ken

What is the cycle?

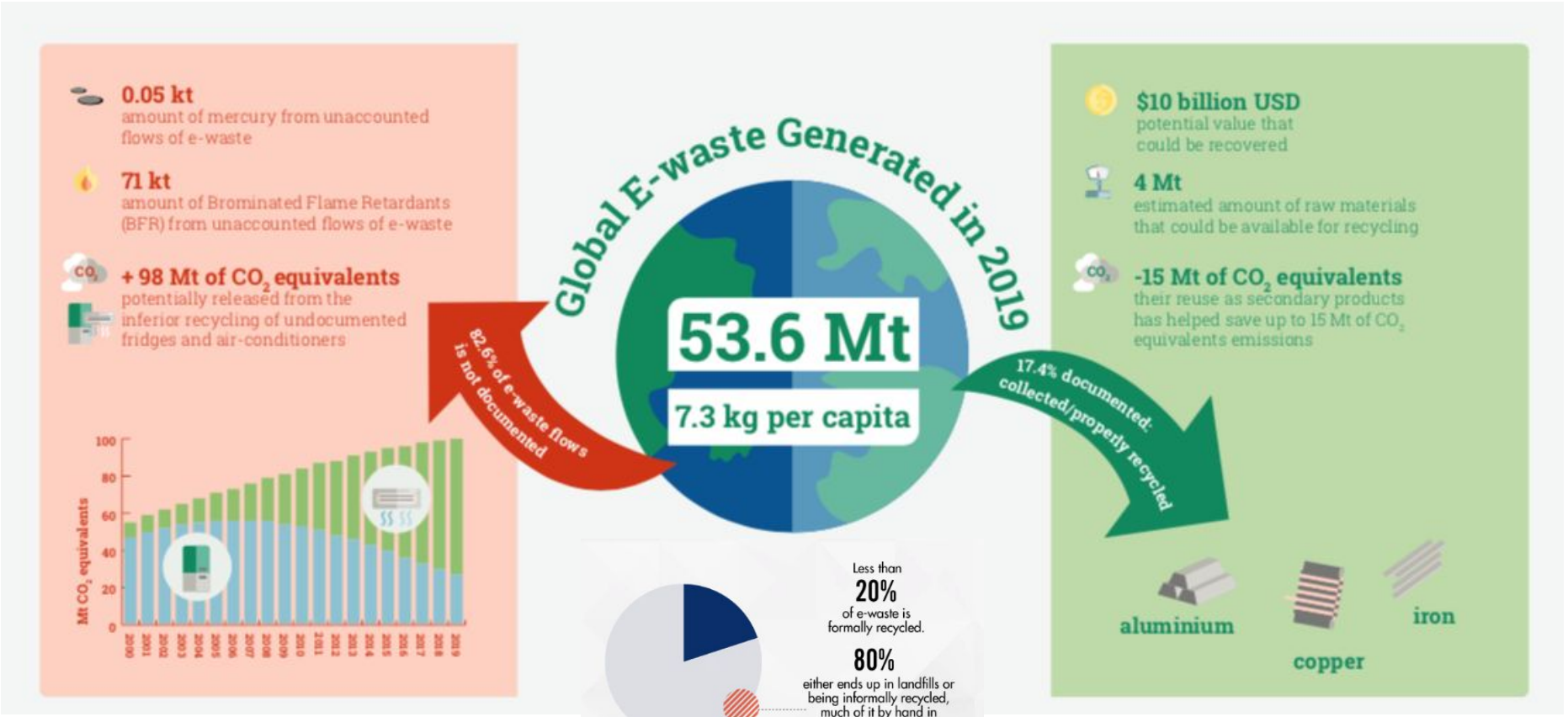


Geissdoerfer, M., Pieroni, M.P., Pigosso, D.C. and Soufani, K. "Circular business models: A review" (PDF). *Journal of Cleaner Production*. **277**: 123741.

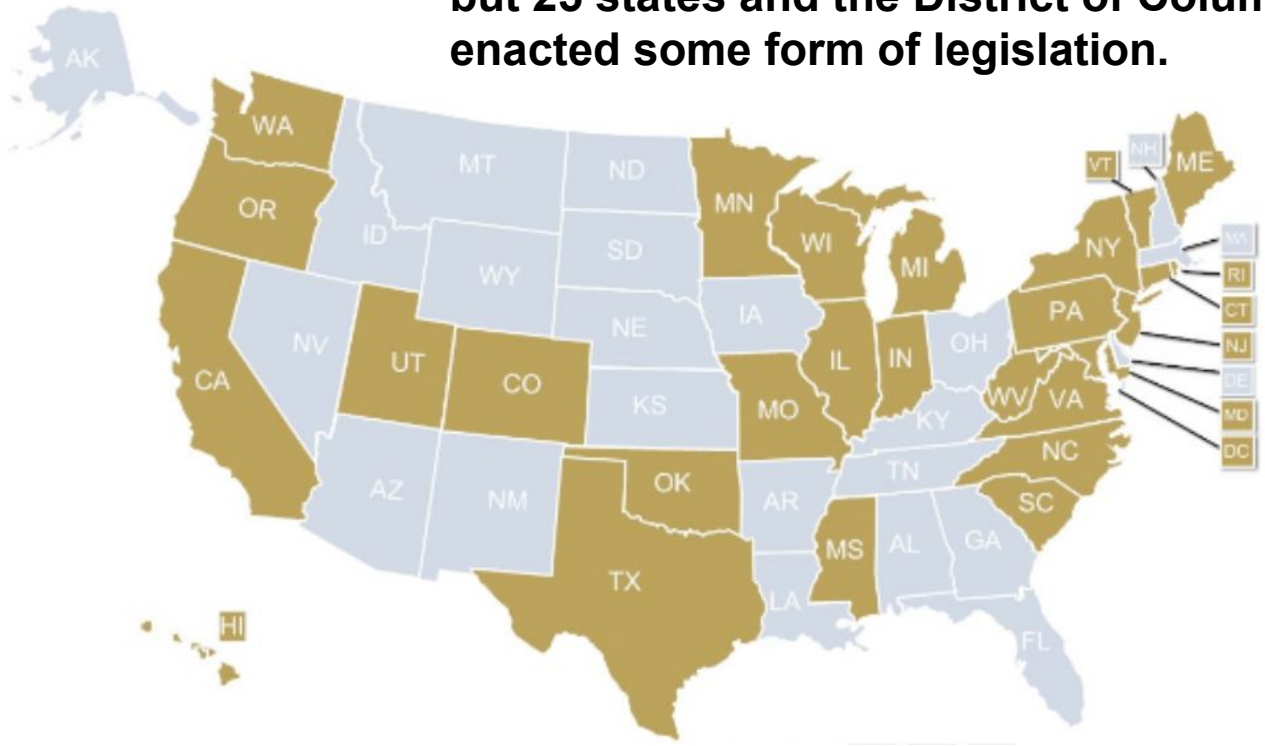
IDEAL


25 Mt
estimated amount of the analysed raw materials in e-waste in 2019
$57 billion USD
potential value of the analysed raw materials in e-waste in 2019
ideal 100% recycling
manufacturing
39 Mt
estimated demand of raw materials for the production of new electronics
14 Mt of virgin raw material
EEE
53.6 Mt
7.3 kg per capita
Global E-waste Generated
recycle
use
kt mill.USD kt mill.USD
Ag 1.2 579 In 0.2 17
Al 3046 6062 Ir 0.001 5
Au 0.2 9481 Os 0.01 108
Bi 0.1 13 Pd 0.1 3532
Co 13 1036 Pt 0.002 71
Cu 1808 10960 Rh 0.01 320
Fe 20466 24645 Ru 0.0003 3
Ge 0.01 0.4 Sb 76 644

ACTUAL


0.05 kt
amount of mercury from unaccounted flows of e-waste
71 kt
amount of Brominated Flame Retardants (BFR) from unaccounted flows of e-waste
+ 98 Mt of CO_2 equivalents
potentially released from the inferior recycling of undocumented fridges and air-conditioners
Global E-waste Generated in 2019
53.6 Mt
7.3 kg per capita
82.6% of e-waste flows is not documented
17.4% documented: collected/properly recycled
$10 billion USD
potential value that could be recovered
4 Mt
estimated amount of raw materials that could be available for recycling
-15 Mt of CO_2 equivalents
their reuse as secondary products has helped save up to 15 Mt of CO_2 equivalents emissions
Mt CO_2 equivalents
aluminium
copper
iron
Less than 20% of e-waste is formally recycled.
80% either ends up in landfills or being informally recycled, much of it by hand in developing countries.

The United States of America does not have national legislation on the management of e-waste, but 25 states and the District of Columbia have enacted some form of legislation.



[Source: https://www.ncsl.org/research/environment-and-natural-resources/e-waste-recycling-legislation.aspx]

Pass to you, Pat.

You can do it!

Government

What it’s done and what it can do

https://www.core77.com/posts/90945/Check-This-List-to-See-if-Your-State-Has-Right-to-Repair-Laws

Digital Millennium Copyright Act 1998

VS

Right To Repair

- DMCA was designed as copyright protection for Intellectual material in the digital age (Great Idea)
- Shorter Use cycles of electronic equipment because people could not repair the devices. (Little stickers warning of danger of voiding warranty, no repair tools or manuals)
- Exemptions must be done for each state and renewed every 3 years.
- The Repair Association founded in 2013, fought for change. (Previously named Digital Right to Repair Coalition)

Protection or Poison Pill

Digital Millennium Copyright Act

Introduction

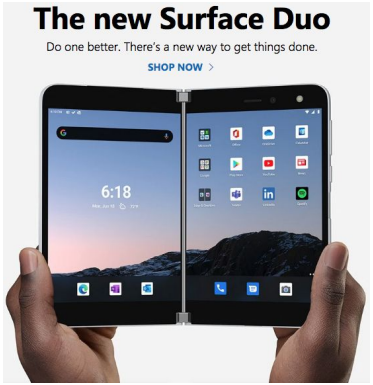
On October 12, 1998, Congress passed the Digital Millennium Copyright Act (DMCA). The law became effective in October 2000 and it has been incorporated into the Copyright Act (Title 17 of the U. S. Code). This landmark legislation updated U.S. copyright law to meet the demands of the Digital Age and to conform U.S. law to the requirements of the World Intellectual Property Organization (WIPO) and treaties that the U.S. signed in 1996.

Despite the work of libraries and other partners, dedicated to preserving the traditional balance in copyright law between protecting information and affording access to it, the DMCA tilts strongly in favor of copyright holders. In addition to creating new rules for digital materials, the DMCA mandates several important studies and reports to be conducted by the U.S. Copyright Office and sets the time frames for their completion.

Divided in to five "titles," the DMCA is a complex act that addresses a number of issues that are of concern to libraries. Among its many provision, the Act:

- imposes rules prohibiting the circumvention of technological protection measures
- sets limitations on copyright infringement liability for online service providers (OSPs)
- expands an existing exemption for making copies of computer programs
- provides a significant updating of the rules and procedures regarding archival preservation
- mandates a study of distance education activities in networked environments
- mandates a study of the effects of anti-circumvention protection rules on the "first sale" doctrine

[Source: http://www.ala.org/advocacy/copyright/dmca#:~:text=Introduction,17%20of%20the%20U.%20S.%20Code]



Repairability: 2/10
By IFIXIT

Apple 16” MacBook Pro

Repairability: 1/10
By IFIXIT

Apple - AirPods Pro

Repairability: 0/10
By IFIXIT

August 7, 2020

The Critical Medical Infrastructure Right-to-Repair Act of 2020 would allow trained repair technicians to more easily access information and tools required to complete maintenance and repair of critical medical infrastructure in preparation for and as part of a response to the current COVID-19 crisis.

Currently...Four States have successfully passed exemptions

Washington - best overall at addressing the needs of individuals trying to repair their own devices.

Wyoming - Only covered farm equipment but did impose a $500 fines for failure to comply.

California - leaves out automotive dealers and manufacturers but has heftier fines
1000/day first violation, 2000/day second violation 5000/day for subsequent violations.

Iowa - It's broad scope defines electronic products as "...a part or product containing a microprocessor"

As of 2019, sixteen other states have begun active legislation. Track the progress of all of them here. States with Active Right to Repair Legislation

Excerpt from the Washington Legislation

The Washington version of the Right to Repair legislation includes a legislated "degree of reparability" requirement. In relevant part, the bill states:

> Original manufacturers of digital electronic products sold on or after January 1, 2019, in Washington state are prohibited from designing or manufacturing digital electronic products in such a way as to prevent reasonable diagnostic or repair functions by an independent repair provider. Preventing reasonable diagnostic or repair functions includes permanently affixing a battery in a manner that makes it difficult or impossible to remove.[149]

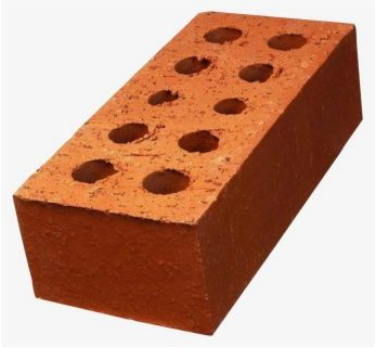
End User Licence Agreements
&
Terms of Service

- Mandated updates can make device unrepairable
  or and even unusable...essentially making the product as useful as a BRICK.

- Legislative, executive and judicial powers are traditionally separated to prevent the abuse of power. EULA's and ToS are solely written and enforced by the technology company - There is virtually no oversight. These terms and agreements are often subject to change at the whim of the company and offer no assurances.

Bricking

IoT companies have the capacity to change products' functionality as these companies can install software updates automatically without users' consent or notification. According to Fitbit: "We reserve the right to determine the timing and content of software updates, which may be automatically downloaded and installed by Fitbit products without prior notice to you" (Fitbit, 2018). Customers can agree to the manufacturers' terms, discontinue use of the product or, in some cases, accept decreased device functionality. For instance, the smart-speaker company Sonos announced in 2017 that if users declined to accept an updated privacy policy, their smart sound systems may "cease to function" (Whittaker, 2017).



Traditionally, when a company discontinued a product, consumers could still use functional goods. With smart products, however, when companies cancel a product line or merge business divisions, they may brick existing devices. After Fitbit acquired the Pebble smart watch in December 2016, for example, it announced that it would cease providing software updates to Pebble, a case similar to Nest's bricking of the Revolv smart home system. After a transition period, Fitbit officially ended its software support for Pebble in June 2018 and encouraged Pebble users to adopt Fitbit products and operating system (Fitbit, 2018a).

Have You Been Bricked?

- **Apple HomePods iOS updates** — In 2019, Apple released the iOS 13.2 update to its line of smart speakers, which basically shut down all functionality to a large number of HomePods. Apple later recalled the update due to customer complaints.

- **MacBook Pro security features** — Normally, we'd say more security is a good thing, but when Apple rolled out their proprietary diagnostic software in 2018, it caused a whole lot of headaches for independent repair shops. Customers who thought they were doing the responsible thing by recycling their old MacBooks, which came with an original price tag of about $3,000 just a few years prior, found that Apple's T2 security chip prevented reuse.

  According to Vice, one affected MacBook refurbisher noted, "you can't get to recovery mode and wipe the machine without a user password, and you can't boot to an external drive and wipe that way because it's prohibited by default," essentially reducing the resale value of the laptops to the cost of their parts as scrap.

https://www.allconnect.com/blog/what-is-bricking

- **Samsung Galaxy Note7 safety hazard** — Bricking was a necessity for the ill-fated Note7, the Samsung smartphone that became known for bursting into flames and was subsequently recalled in 2016. Since not all consumers returned their affected devices, Samsung sent out an update to brick the devices, which permanently shut off the phone's data connections and prevented the device from charging.

- **Sonos "recycling mode"** — In 2019, "high-end speaker manufacturer Sonos announced it would no longer be providing software updates to any hardware that was released prior to 2011," according to Popular Mechanics. Customers were told they could put their devices into "Recycle Mode," rendering the product unusable (as in, it can't even be resold), and trade it in to get 30% off new Sonos products.

  Of course, with a price tag starting around $200 per speaker, and easily adding up to over a thousand dollars for a complete home audio system, that so-called deal rubbed some Sonos buyers the wrong way. Six months later, after the customer uproar became impossible to ignore, Sonos changed course, somewhat. The company still will end support for their older "legacy" devices eventually, but customers will not have to brick their old speakers. They can sell them, re-gift them or whatever else they choose.

https://www.allconnect.com/blog/what-is-bricking

Learn More....

https://www.repair.org/

Right-to-Repair-Laws in YOUR state

Great review on Terms of Service (TOS)

We need to educate people about what laws exist and how they affect our current situation.

We made a game.

Do you feel like we should push for Federal Regulation?

Pass to Ken.

Think it’s going well...Take it home!

THE GAME

Title: (if) E.T. Saw e-Waste

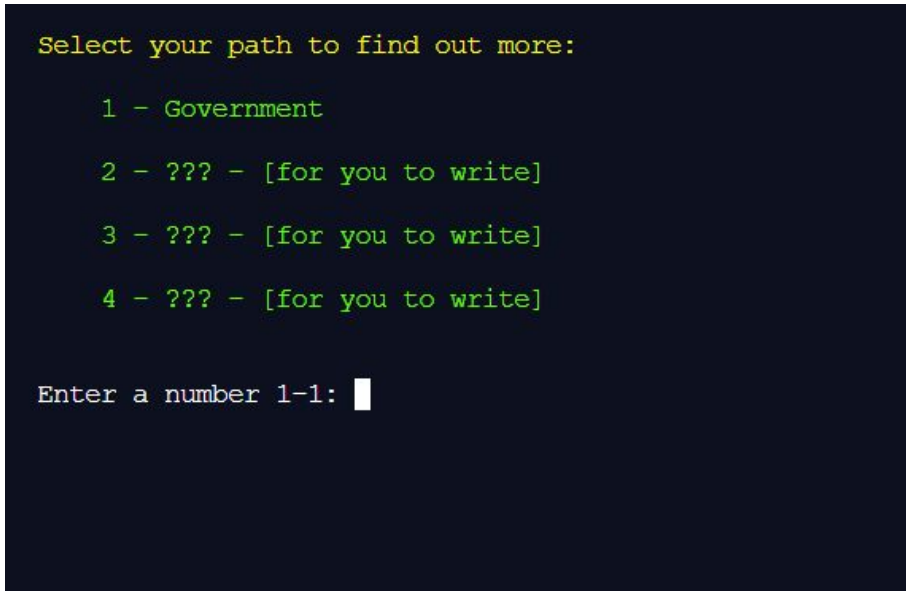
Link: https://repl.it/@kchung3/ET-Saw-E-waste

Description:

A choose-your-own adventure style game used for learning/teaching about different aspects of the e-waste issue and what we can do to address those problems. The program is built to handle multiple "stories" or perspectives on the e-waste cycle with the purpose of initiating change through educating.

Government - Role

We have only written out one specific point about how government regulation - specifically addressing the Digital Millennium Copyright Act - can help reduce e-waste through Right to Repair legislation.



What other roles / perspectives can you and your students work on?

Companies roles in affecting e-waste:

Microsoft commits to achieve 'zero waste' goals by 2030

Manufacturing Process -
sustainable,carbon neutral

Design -
Reducing hazardous materials

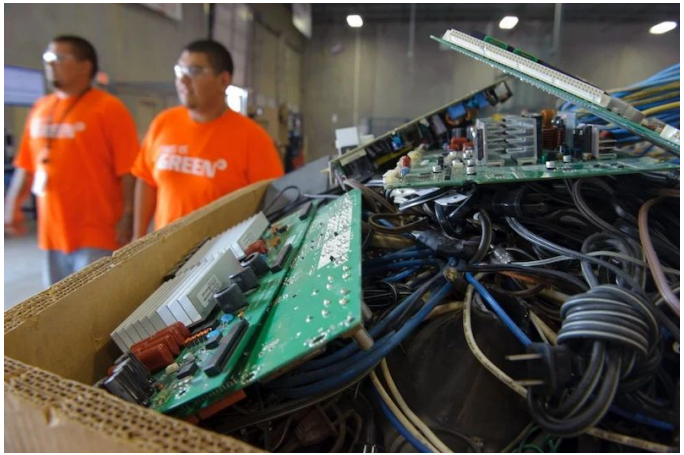
Extending product life -
by allowing for repair and refurbishment

https://www.youtube.com/watch?v=8nr1gzGdfx0

Should Engineers take Ethics?

What role do engineers have in the e-waste cycle?

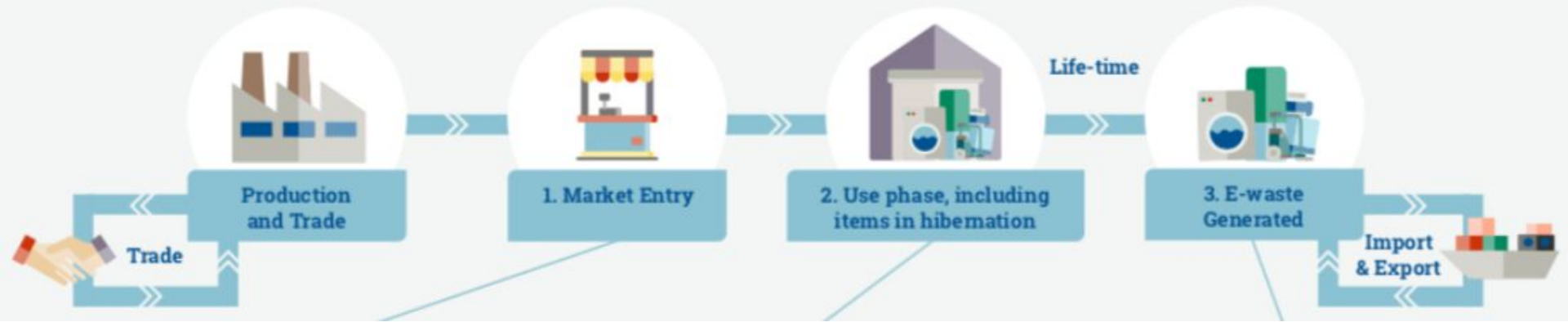
Read more:
https://www.allaboutcircuits.com/news/the-ethics-of-e-waste-is-an-engineer-culpable-for-the-50-million-tons-of-electronic-waste/



Track the entire life of one EEE

EEE - Electrical and Electronic Equipment

- Pick one device and follow its life from:
  - Production to Sale to Use-Reuse-Repurpose-Recycle to Trash



What about the rest of the world?

The United Nations

Read about legislation in other countries:
https://www.itu.int/myitu/-/media/Publications/2020-Publications/Global-E-waste-Monitor-2020.pdf

- **Africa**
  - **Canada**
    - **Latin America**
      - **Asia**
        - **Australia**