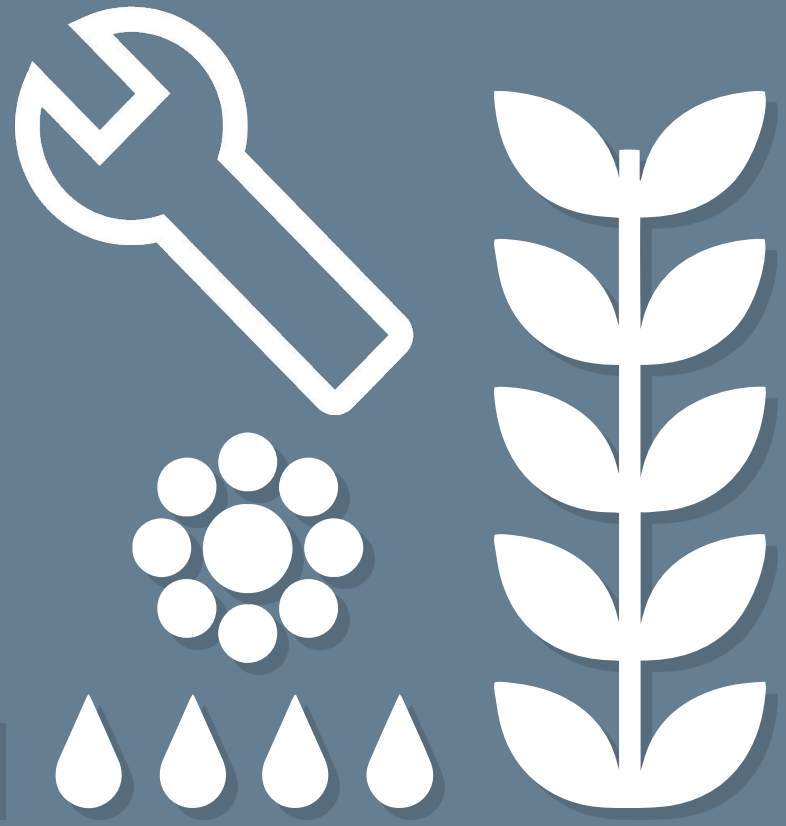
Waste is a Design Flaw

ENGR 1501 FALL 2023 - Week 5



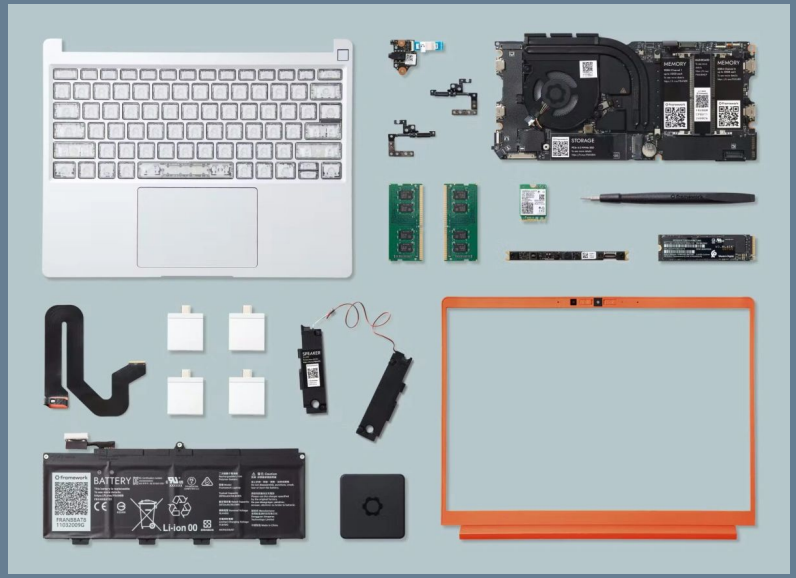
Attendance

Review: Framework's latest modular laptop is one I could stick with for years

Devin Coldewey @techcrunch / 11:31 AM EDT • July 23, 2022

Comment

Image Credits: Framework


MEMORY
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BATTERY
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Today's Agenda

1. REDUCE WASTE
2. DESIGN WASTE OUT
3. DESIGN WITH WASTE
4. DESIGN IDEA PLAN

Course Objectives

- Learn how waste creation is designed into our linear economy
- Understand engineering frameworks for designing “out” waste and designing with waste
- Explore what main components make up electronics and how to work them
- Create a Circular Engineering outline for an E-waste product

How your e-waste is currently disposed of/recycled

Research and describe what happens to your e-waste when it is discarded?
How can a consumer recycle your e-waste?

Designing for End-Of LifeCycle

How would you design the device to not create waste?

How would you make it: open to improvement, open to maintenance, recyclable, refurbishable, salvageable, recycling of each part etc.

Any novel ideas? Can be wild

Based off the previous critique, comment how you would improve each flaw to create a more sustainable design. You can reference numbers from the previous slide if critique is a list.

Waste designed into Echo products

-Hardware

There is no way for an average person to fix their device when broken

-Software

Software is inherently meant to last forever, but errors and flaws make basic functions unreliable

-System

New products every year "better" than the last

Customer service is helpful with software but unable to help with most hardware issues

People are limited with modular improvement because of the use of unique echo components.

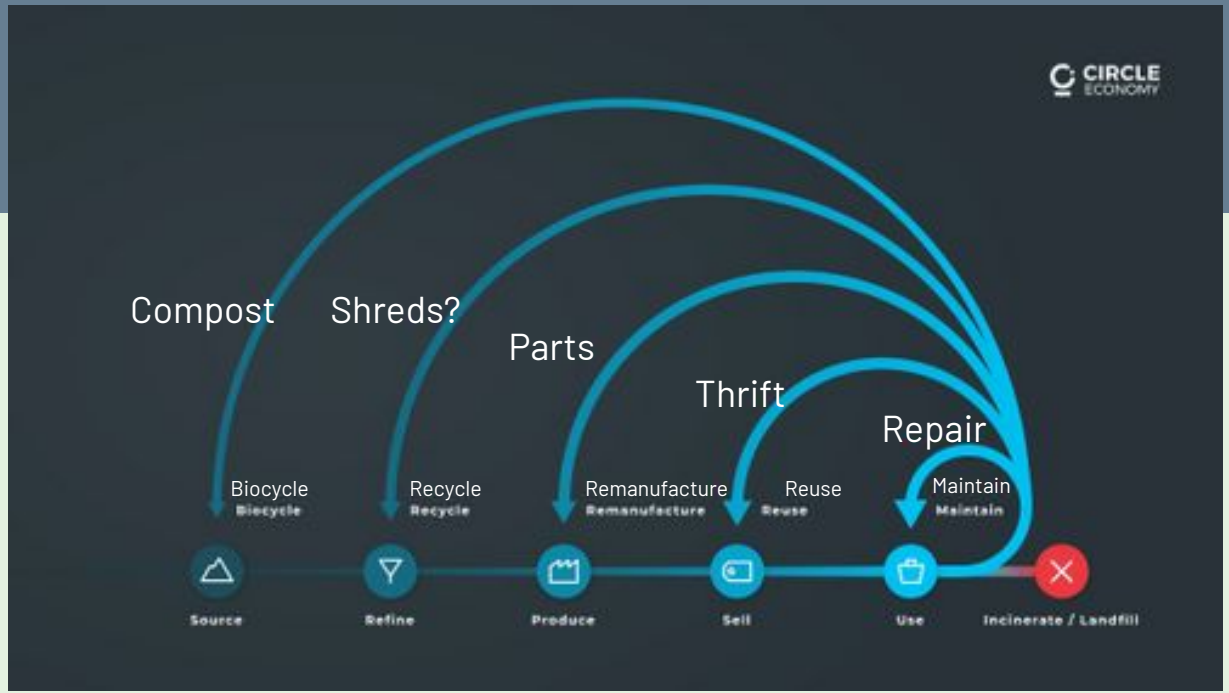
They use glue and unique screw heads in order to discourage the taking apart of a device, instead of clip on parts or phillips head screws.

E-waste lifecycle

1. When a device becomes waste
2. How a device becomes waste
3. Available waste streams

CIRCULAR ECONOMY

Common Language for reintegration process



HOW TO REDUCE E-WASTE

HOW TO REDUCE E-WASTE

1. Designing devices so they don’t become waste **(Pre-waste)**
2. Turning waste into material streams **(Post-waste)**

HOW TO REDUCE E-WASTE

Sustainable Design (Pre-Waste)

Hardware

Software

System

What is your process of identifying a principle of sustainable design?

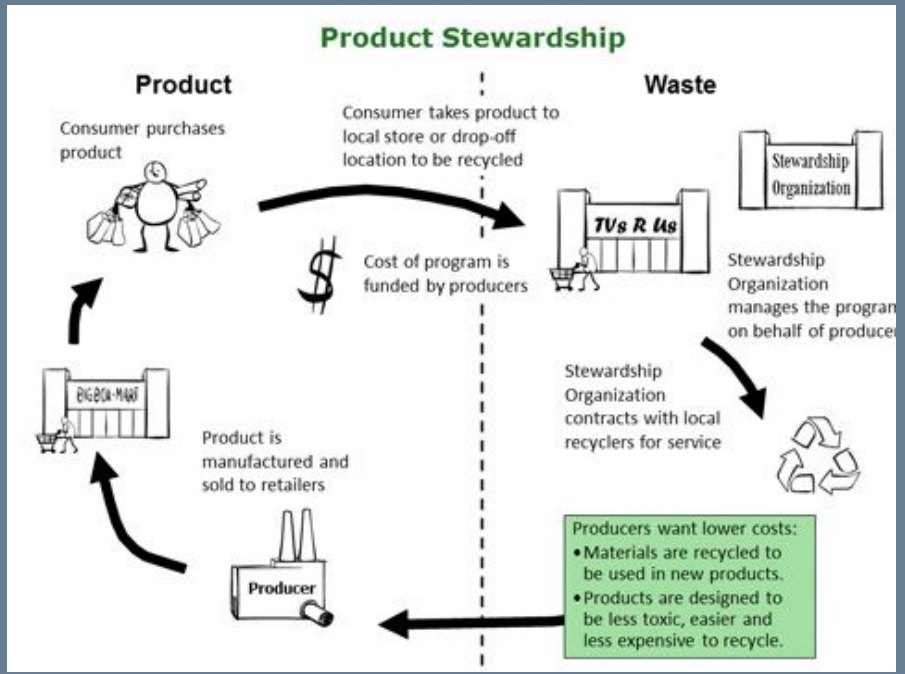
Sustainable Design

[sə-ˈstā-nə-bəl di-ˈzīn]

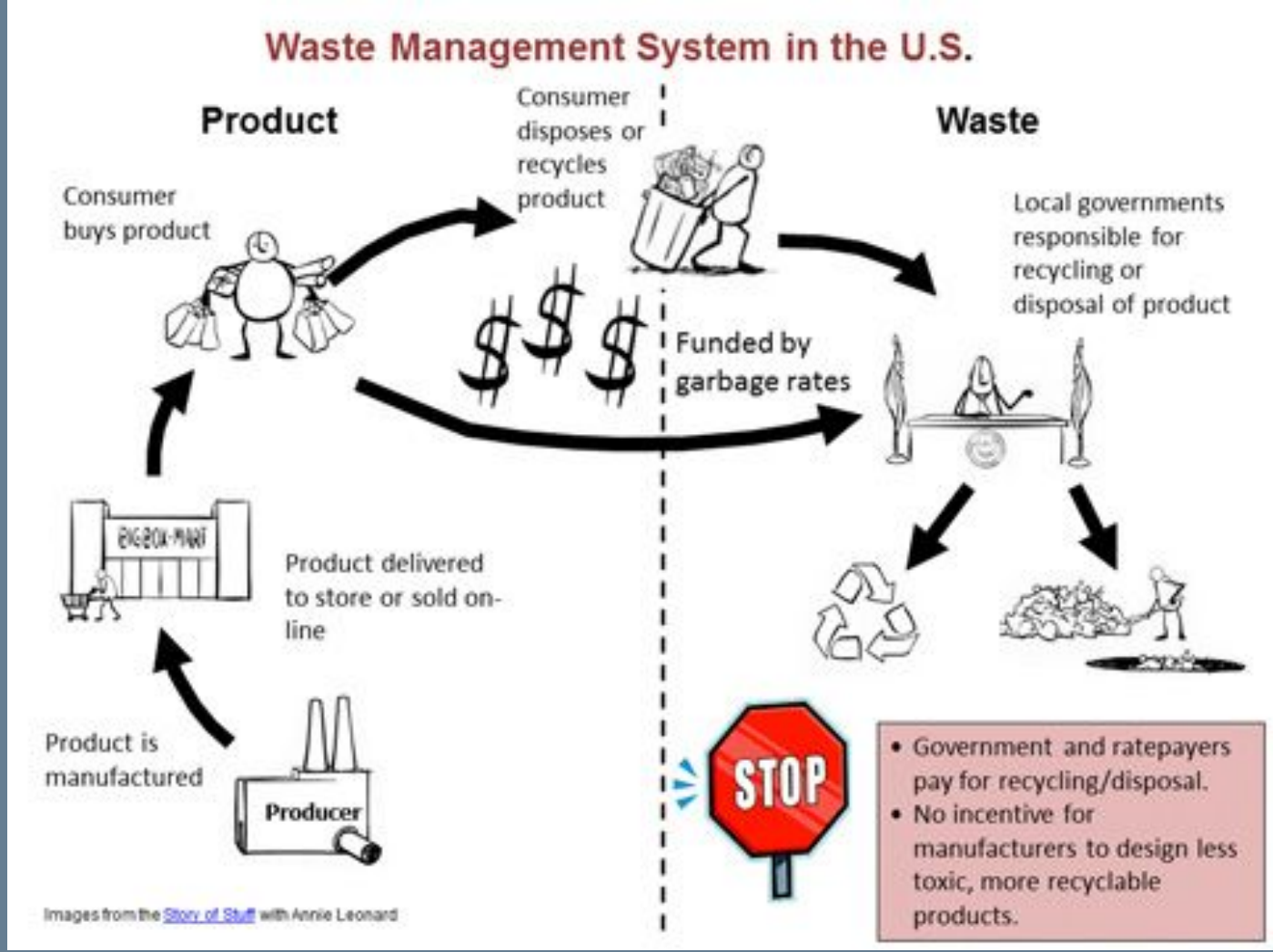
A design approach that seeks to minimize negative environmental, social, and economic impacts.

Sustainable Design

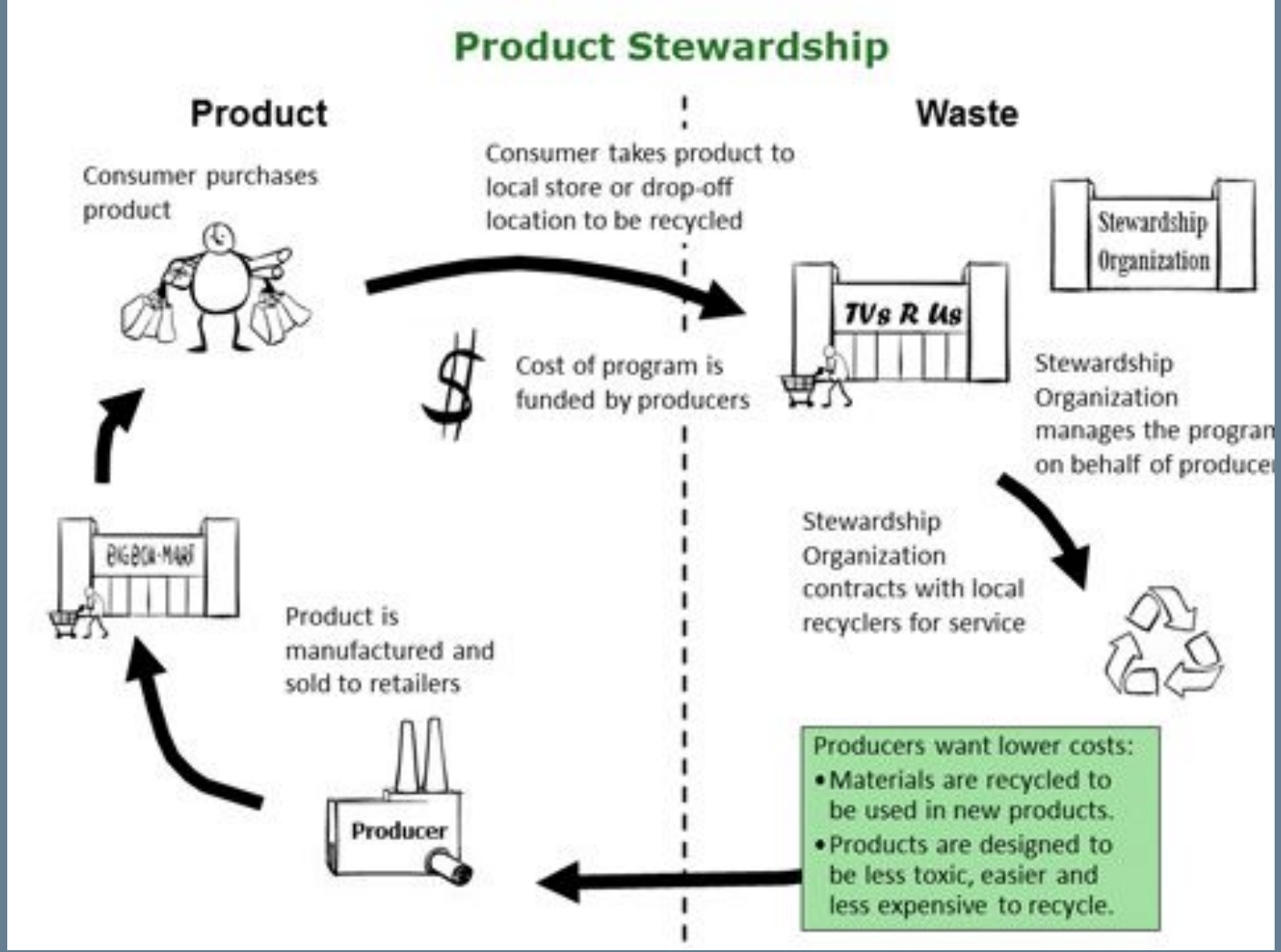
Product Stewardship



Waste Management System in the U.S.



Product Stewardship



Product Stewardship

Companies design products WITH an end-of-life plan.

How?

Product Stewardship

The 12 Principles of Green Engineering

Principle 1: Designers need to strive to ensure that all material and energy inputs and outputs are as inherently nonhazardous as possible.

Principle 2: It is better to prevent waste than to treat or clean up waste after it is formed.

Principle 3: Separation and purification operations should be designed to minimize energy consumption and materials use.

Principle 4: Products, processes, and systems should be designed to maximize mass, energy, space, and time efficiency.

Principle 5: Products, processes, and systems should be "output pulled" rather than "input pushed" through the use of energy and materials.

Principle 6: Embedded entropy and complexity must be viewed as an investment when making design choices on recycle, reuse, or beneficial disposition.

Principle 7: Targeted durability, not immortality, should be a design goal.

Principle 8: Design for unnecessary capacity or capability (e.g., "one size fits all") solutions should be considered a design flaw.

Principle 9: Material diversity in multicomponent products should be minimized to promote disassembly and value retention.

Principle 10: Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.

Principle 11: Products, processes, and systems should be designed for performance in a commercial "afterlife".

Principle 12: Material and energy inputs should be renewable rather than depleting.

Through *the* 12 Principles GREEN *Engineering*

Let's make a memorable summary phrase/word for each principle so they can be easily referenced

We will also go through any questions you all have on the principles for how to implement and what they mean.

We will be testing Miro for this, so please go to the announcements page on Collab

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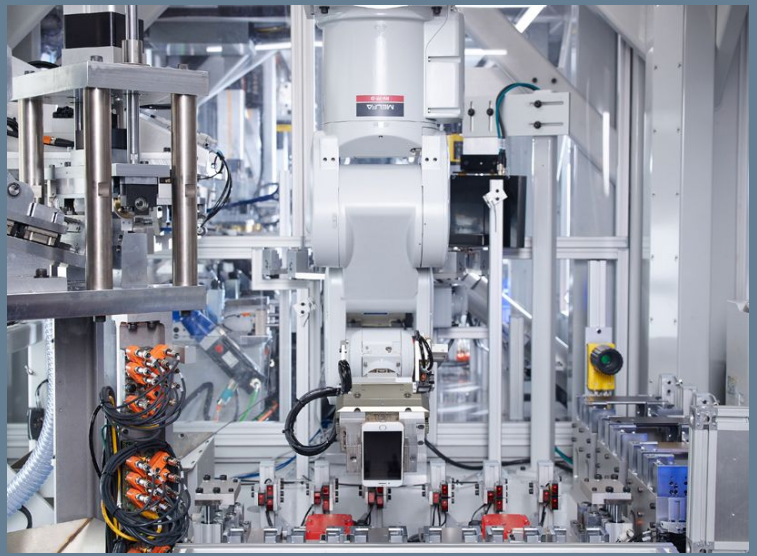
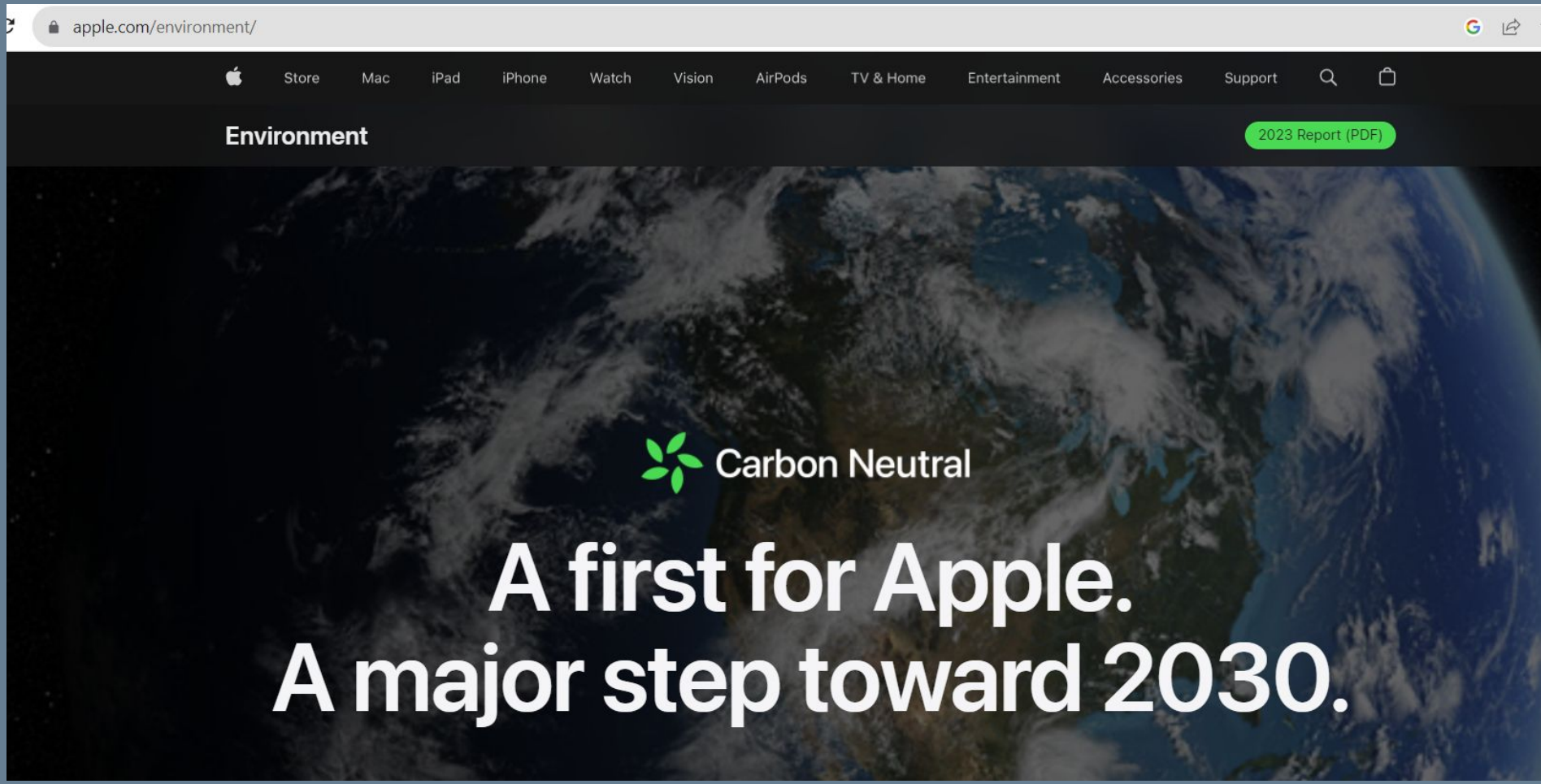
Examples of Product Stewardship

Apple Recycling their Own Phones

- How? What is the success rate?
  - What defines success?
  - What feels fishy?
  - What would you want to see?




apple.com/environment/
Store
Mac
iPad
iPhone
Watch
Vision
AirPods
TV & Home
Entertainment
Accessories
Support
Environment
2023 Report (PDF)
Carbon Neutral
A first for Apple.
A major step toward 2030.


ORIGINAL
ORIGINAL TASTE
16 FL OZ
(1 PT)
473 mL
190

Examples of Product Stewardship

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Refill Products

Modular Products

Recyclable Products (?)

Sustainable Design with Waste (Post)

Input pushed design.

Sustainable Design with Waste (Post)

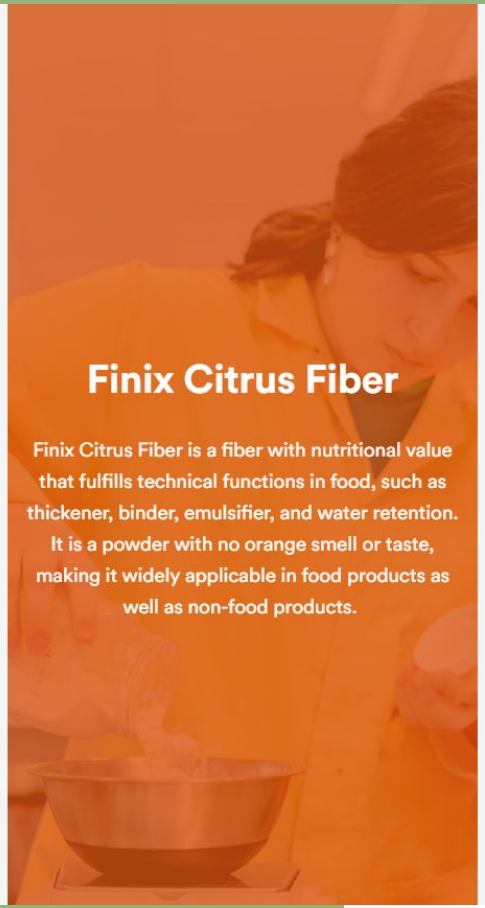
Input pushed design.

We can identify waste streams and reorient them so the “waste” becomes a material input for a new product/process!

Sustainable Design with Waste (Post)

Simone Post - Post Adidas

The age of waste: five designers modelling a 'circular economy'



Finix Citrus Fiber

Finix Citrus Fiber is a fiber with nutritional value that fulfills technical functions in food, such as thickener, binder, emulsifier, and water retention. It is a powder with no orange smell or taste, making it widely applicable in food products as well as non-food products.

Five Fold Oil

Five Fold Oil is concentrated orange oil that can provide food and personal care products with a delicious orange aroma.

Cold Pressed Oil

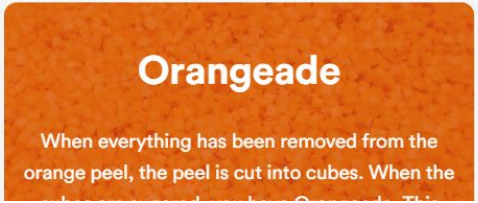
Cold Pressed Oil is pressed directly from the orange peel and purified with minimal further processing.

D-Limonene

D-Limonene is a degreasing and natural solvent that is used to make cleaning products, among other things.

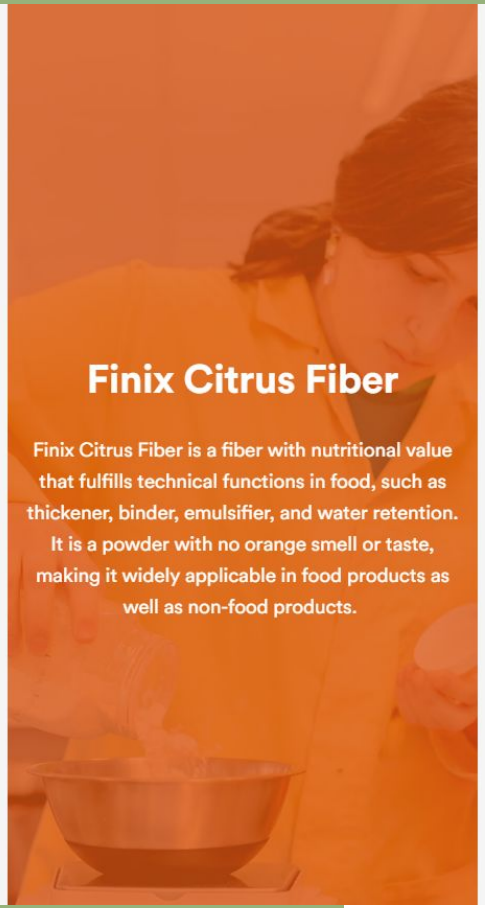
We keep developing

In our (in-house) innovation lab we are constantly doing research on what more ingredients we can extract from citrus peel. In addition, we also carry out various tests to build knowledge on the functionality of our ingredients in the different applications. There is still so much potential! We continue to develop together with our partners.



Orangeade

When everything has been removed from the orange peel, the peel is cut into cubes. When the



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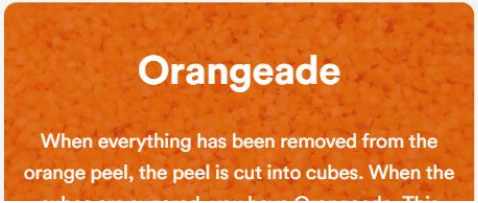

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Sustainable Design with Waste (Post)

Input pushed design...

AND output pulled.

Recycling with a purpose vs. making to use. We should design products to serve a purpose.

The designed proc

life-cycle should b

What to make with waste?

Ship of theseus

- Aluminum cans, glass bottles, clothing, etc.

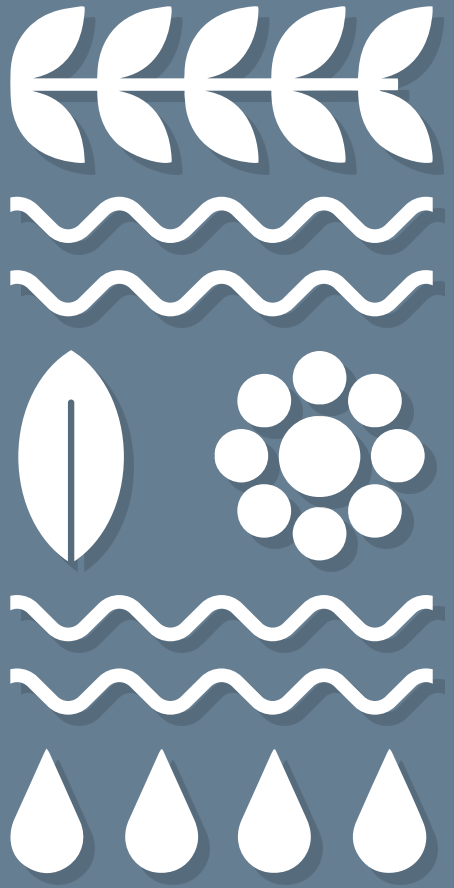
New products!

- Creating an existing product out of sustainable materials (cheaper and sustainably sourced)
- Identifying community need
- Fun!

How do you envision how your product can be reused/refurbished rather than recycled in this “grinding” technique?

What limits do you see?

How could you see your product redesigned so it is more easily repaired, reused, recycled?



Thought for the class:

"All too often, the concern around the environmental impact of electronics focuses almost obsessively on what happens to consumer's devices after they supposedly throw them away," says Lepawsky. "The amount of pollution and waste that occurs on the manufacturing side of things is hugely larger than the weight of materials that consumers get rid of, in the aggregate, after they stop using their devices."

Recommended Media:
iFixit Website- Start looking at how we will disassemble our E-waste examples

Appendix Slides

The 12 Principles of Green Engineering

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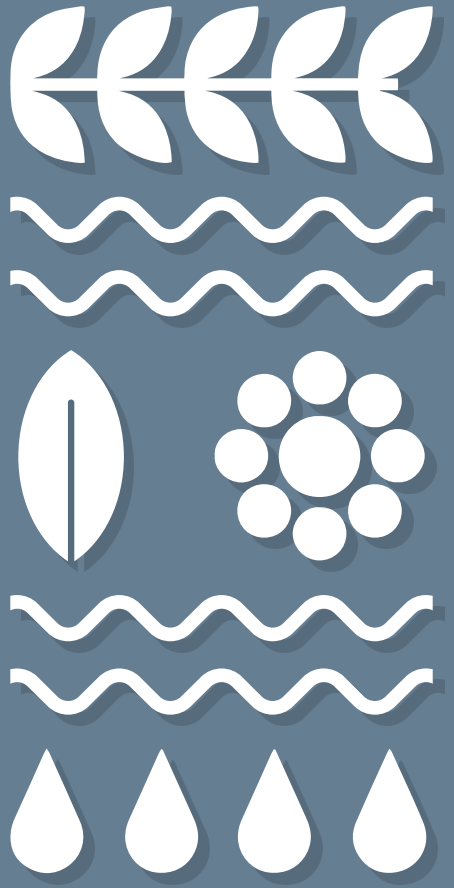
That means each year we waste 90 billion tons of resources. This also means that we create 90 billion tons of potential resources.

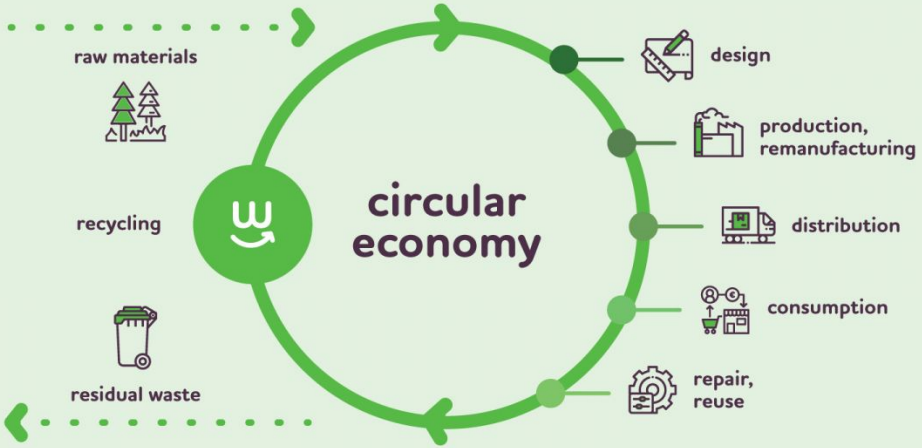
The current dominant economy is linear in its processes: it takes resources, makes goods, and quickly wastes them.

-CIRCLE REPORT, 2021



CIRCLE ECONOMY

The circular economy is an economic system where waste is designed out, everything is used at its highest possible value for as long as possible and natural systems are regenerated.



These 2 will be our main focus

USE **WASTE** AS A RESOURCE

Utilise waste streams as a source of secondary resources and recover waste for reuse and recycling.

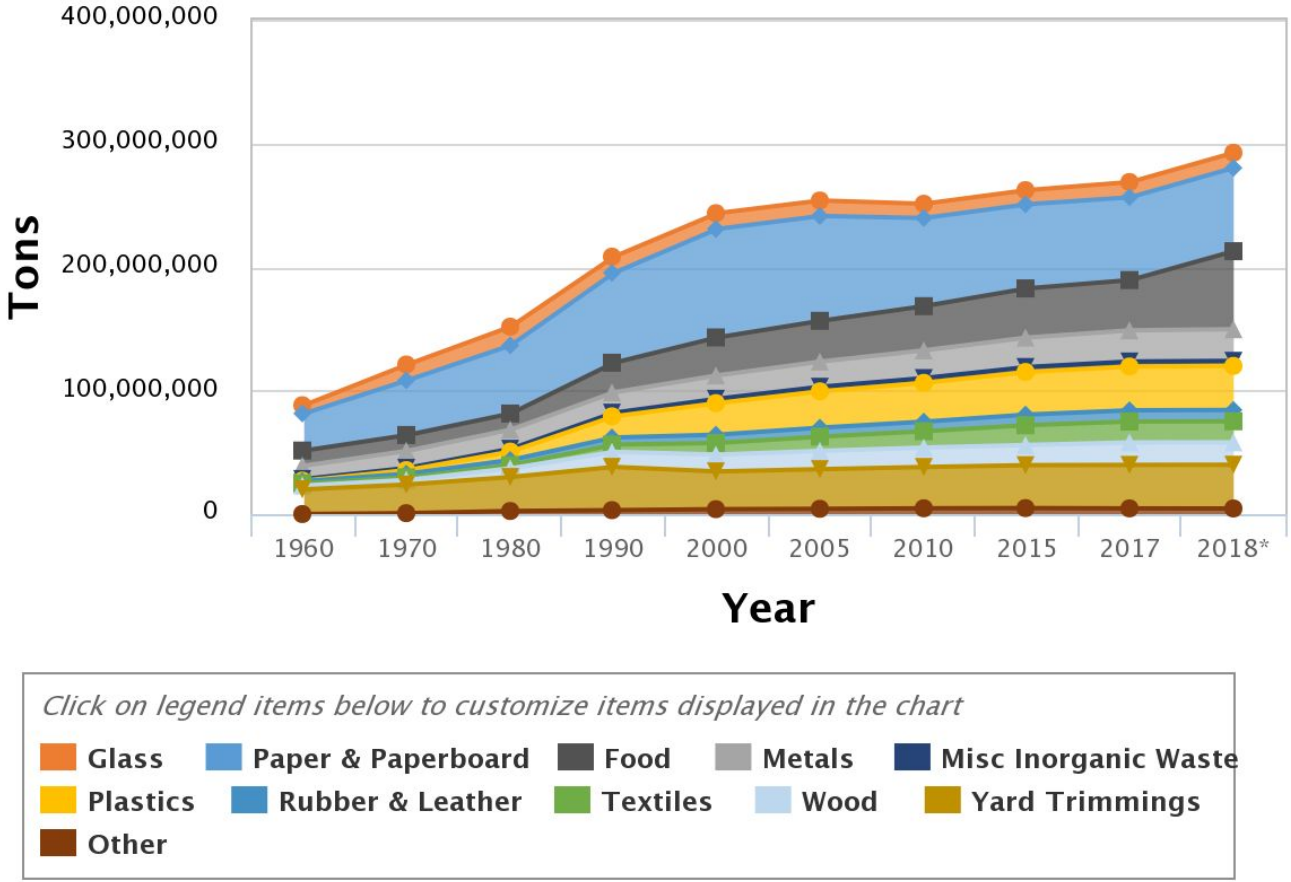
STRETCH THE LIFETIME

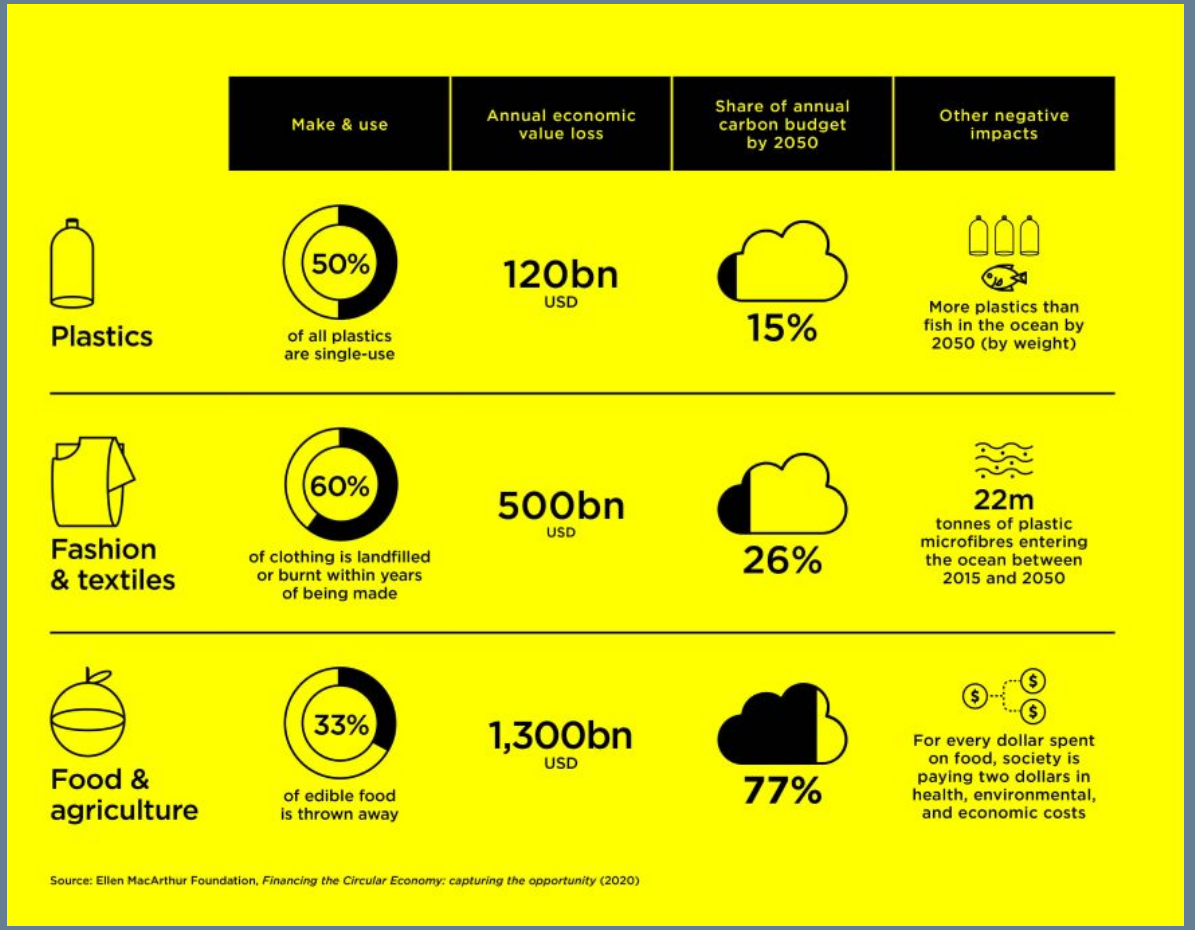
While resources are in-use, maintain, repair and upgrade them to maximise their lifetime and give them a second life through take back strategies when applicable.

Class Naming Convention of 12 Principles

1. Safety First
2. Prevention
3. Low resource separation and purification
4. Optimization
5. Limit Extraneous thinking
6. Hard Work to Salvage Gold
7. Realistic Design Goals (Durability)
8. Necessary design
9. Minimize material diversity
10. Integration and interconnectivity of resources
11. Long-term designing
12. Renewable sources

- Average U.S. person produces 4.9 pounds of waste per day
- That's 1,788.5 pounds a year. Almost a full TON per person.




Make & use
Annual economic value loss
Share of annual carbon budget by 2050
Other negative impacts
Plastics
50%
of all plastics are single-use
120bn
USD
15%
More plastics than fish in the ocean by 2050 (by weight)
Fashion & textiles
60%
of clothing is landfilled or burnt within years of being made
500bn
USD
26%
22m
tonnes of plastic microfibres entering the ocean between 2015 and 2050
Food & agriculture
33%
of edible food is thrown away
1,300bn
USD
77%
For every dollar spent on food, society is paying two dollars in health, environmental, and economic costs
Source: Ellen MacArthur Foundation, Financing the Circular Economy: capturing the opportunity (2020)

CIRCLE ECONOMY

Common Language for reintegration process