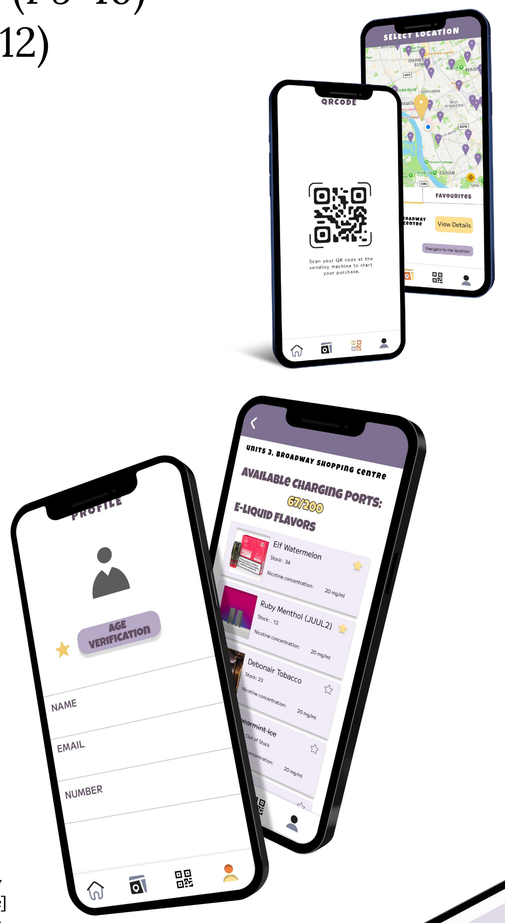
COMBIVAPE

Chritian Grose - Infrastructure (P7-8)
Qinxuan Li - Data & Actors (P9-10)
Miaoyan Tang - Value (P11-12)















Reference

1. Material Focus (2022). One million single use vapes thrown away every week contributing to the growing e-waste challenge in the UK. [online] Material Focus. Available at: https://www.materialfocus.org.uk/press-releases/one-million-single-use-vapes-thrown-away-every-week-contributing-to-the-growing-e-waste-challenge-in-the-uk/.

2. https://researchbriefings.files.parliament.uk/documents/CDP-2022-0216/CDP-2022-0216.pdf

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4. The Challenges of Recycling Single-Use Vapes. (n.d.). Available at: https://d4a921.n3cdn1.secureserver.net/wp-content/uploads/2023/09/The-challenges-of-recycling-single-use-vapes-A-Waste-Experts-Report.pdf [Accessed 22 Oct. 2023].

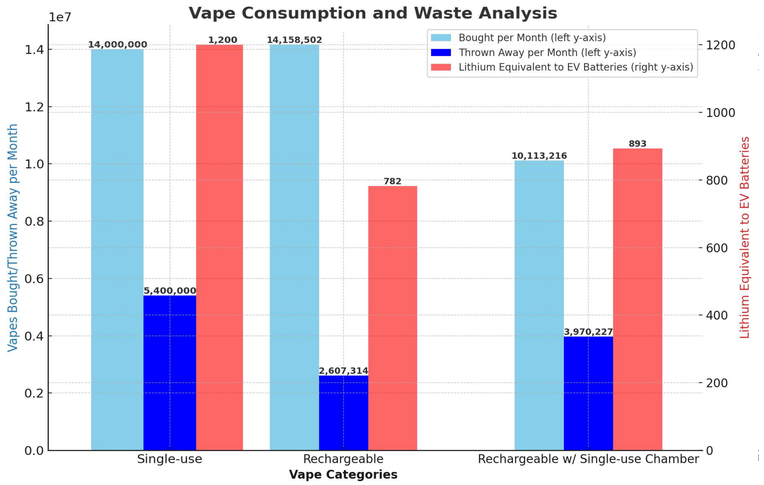
5. Hambly, E. (2022). Should disposable vapes be banned? BBC News. [online] 24 Oct. Available at: https://www.bbc.co.uk/news/science-environment-63037553.

6. The Challenges of Recycling Single-Use Vapes. (n.d.). Available at: https://d4a921.n3cdn1.secureserver.net/wp-content/uploads/2023/09/The-challenges-of-recycling-single-use-vapes-A-Waste-Experts-Report.pdf [Accessed 22 Oct. 2023].

CURRENT PROBLEMS OF DISPOSABLE VAPES INDUSTRY

Disposable VapeSystem Issues

Disposable Vapes



The plot shows that single-use vapes have contributed to the highest lithium disposal per year, which is equivalent to 1,200 electrical vehicles batteries.
It also has the highest disposal rate (over 50%) (1).

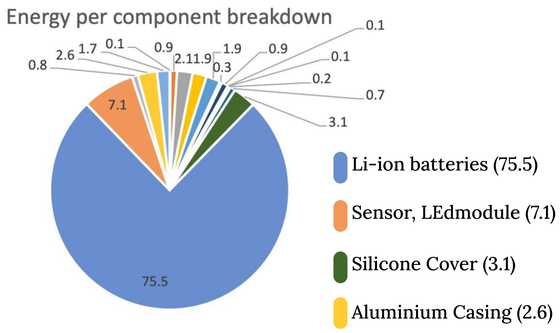
Disposable vapes are the most environmentally detrimental. hence, we're zeroing in on the disposable segment.

Batteries' Dominant Energy Footprint in Vape Products & Their Disposal Risks



Single use vapes （2）
- Over 50% of single-use vapes get thrown away
- 1.3 million single-use vapes thrown away every week or 5.4 million per month
- 10 tonnes of lithium a year, equivalent to the batteries inside 1,200 electric vehicles.
- Lithium rechargeable batteries can in fact be reused for over 300-500 cycles

Landfilling batteries can lead to soil contamination and poses risks of fire or explosions during transportation and compression.



An Eco-audit of the popular Elf bar reveals that over 80% of its embodied energy is attributed to the batteries.

Extend battery life in disposable vapes by reusing them for 300-500 cycles, followed by recycling and repurposing into new batteries, thereby minimizing new production and incorporating recycled materials.

Incomplete Recycling Coverage for Disposable Vapes

Noncompliance with WEEE regulations: 90% of smaller Uk vape and vape juice are not registered under WEEE regulations, which means they are not comtplying with the long-standing environmental regulations. (reported March 2023) (3)

Simplify WEEE Compliance for Retailers with streamlined processes and incentives, and establish partnerships with waste management services for efficient disposal and recycling.

High Carbon Footprint and Limitations in Recycling for Vape Production

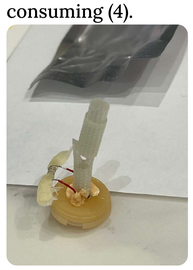
Due to the majority of manufacturing factories being situated in China (the first 5 best sale brands ELf, Elux, SKE, Vuse, Geek are all manufactured in Shezhen, China), a significant distance from the UK, the transportation of vapes results in a substantial carbon footprint. Furthermore, the constraints in the recycling process hinder the possibility of utilizing recycled materials for the creation of new products of the same brand type."

Shift towards local manufacturing to reduce transportation emissions.

Product Design Problems

Hard to disassemble

Most disposable vapes are not designed for easy disassembly, and their varied shapes and complex internal structures across different brands complicate the process.(picture the the left) This necessitates manual dismantling, which is both costly and time-consuming (4).





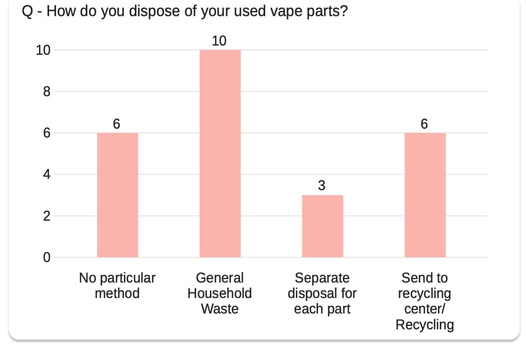
Learn from current innovative modular designs which are more easily disassembled. (picture at the right)

User Challenges

Data plot based on a survey conducted on prolific.com with 13 vaping participants.

User's unawareness and uncompliance to disposable vapes recyclability

Most users directly throw vapes into regular household waste because they don't know vapes can be recycled (5) and they don't know they have easy recycling access (6).



Develop a vape system mandating user returns of used vapes, enabling recycling centers to collect them in bulk from retailers.

User Preference for Disposable Vapes: A Challenge for Sustainable Alternatives

Q - What key factors do you value when buying a vape product? (1: value the most; 5: value the least)

Field	Mean
Price	3.00
Quality	3.35
E-liquid flavor	3.55
Battery life	4.45
Brand reputation	4.80
Look	5.10
Sustainability	5.45
Other:	6.30

Refillable, rechargeable vapes are more environmentally friendly, but many customers prefer disposable vapes for their low maintenance and cost.

This indicates a need to innovate reusable vapes to match the convenience and affordability of disposables, thus encouraging a shift towards sustainability. A potential solution is designing a system where vapes don't require manual refilling or recharging, maintaining a disposable-like experience for users.

SYSTEM IN 3 YEARS

- In return, these companies enhance their sustainable image and share profits.
- Sales data informs product design and guides the tracking of profits and sustainability metrics.
- granting them the right to sell their products.
- Vape companies enter into contracts with a Design Team,


- Combivape (CV) provides white molds for customization. Brands personalize molds' colors, logos, or patterns and send the design to DT.
- CV track customization requests, manufacturing specifications, along with material use and sustainability throughout the production process.
- CV ensures product individuality through tailored manufacturing.
- CV facilitates the Casing manufacturing process based on vape brands' designs. CV production of batteries, electronic components, and vending machines.

- Retailers provide space and utilities for vending machines. Profit sharing arrangement between retailers and the Combivape.
- Sales data informs the Combivape's inventory decisions. Tracking of vending machine usage and casing returns.
- Retailers' responsibility for damage reporting. CV uses sales analysis to manage and restock vending machine inventory.
- Retailers host vending machines; Combivape handles inventory. Automatic notifications for recycling center pickups.

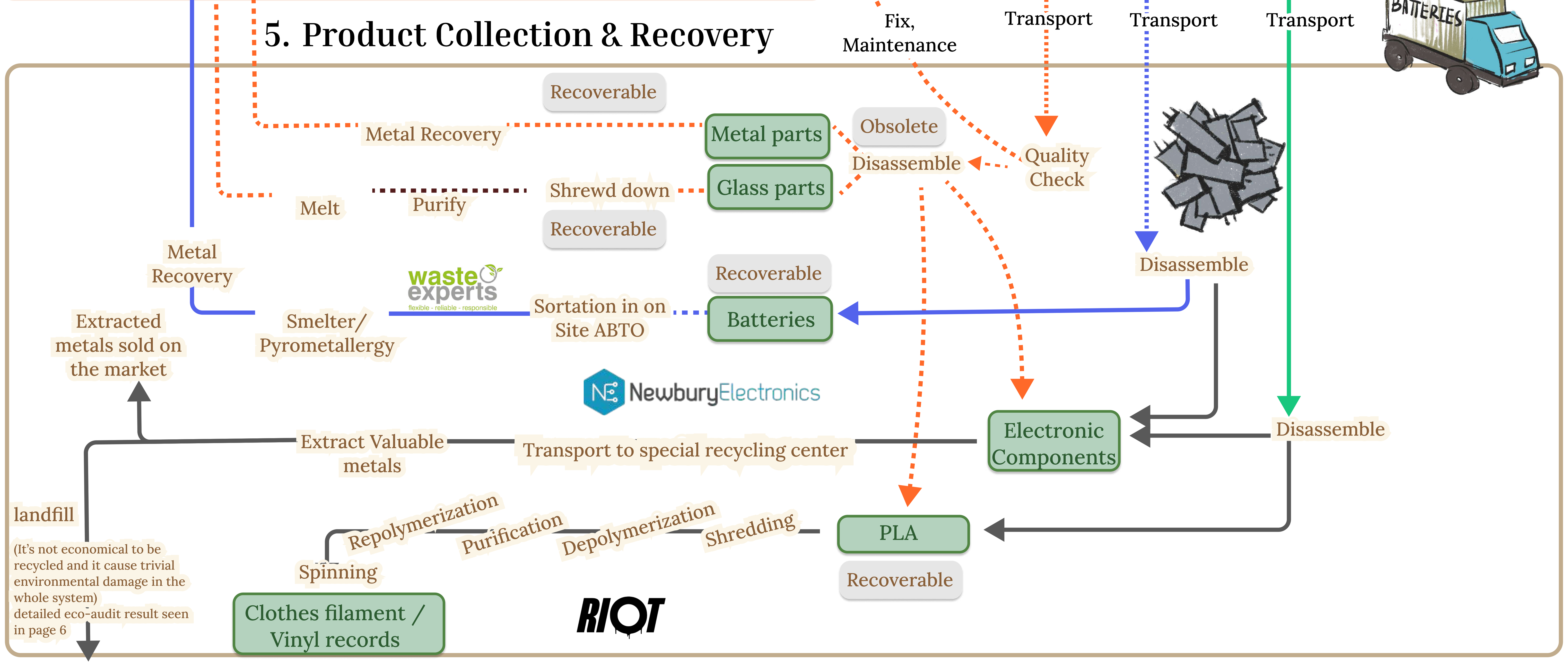
- Users access machines with ID (guest mode) or app QR code (user mode). Option to rent products with flavor selection.
- Tracking of rental duration and penalties. Monitoring product returns and flavor preferences.
- Age verification for responsible use. Penalty system for timely product return.
- Machines equipped for guest mode access and product dispensing. App integration showing nearby machine locations.

2. Manufacturing & Distribution

3. Retailers & Vending Machine



5. Product Collection & Recovery



Material — Process —

Principles · Values · Data · Infrastruture

Resource States

Actors

- Manufactures
- Retailers
- Users
- Recycling Center
- Design Team

- Vending Machine
- Batteries
- E-liquid & Casing

- Recycling center tracks casing and battery conditions for improvement. Regular maintenance extends machine life and minimizes waste.
- Documentation of recycling outcomes and maintenance records. Tracking landfill disposal of non-recyclable electronic modules.
- Commitment to continuous product design improvement. Prioritizing repair and reuse over disposal.
- Systematic disassembly and remanufacturing of battery components. Transformation of PLA casings into new products (clothes fibre and vinyl record).

PLA casings recycled via RIOT model; batteries follow Waste Expert method; PCBs recycled by NewburyElectronics.

PRODUCT DESIGN

Our product is designed in such a way that it is appropriate for the system we have designed. Therefore there were specifications.

Specifications:

1. Using the product should be the same experience as a disposable vape:
   a. Same form factor.
   b. Same aesthetics

2. There must be a clear indication that the product should be returned on the product.

3. The product must be able to be taken apart the vending machine but not be the user for safety reasons.

4. The product should have a unique identification number (barcode) to allow for data tracking throughout the life cycle (inventory, use, return, disposal, littering locations etc.).

5. Minimal materials and assembly processes should be used with an intention put into ease of disassembly and recyclability at the final disposal stage of the two parts.

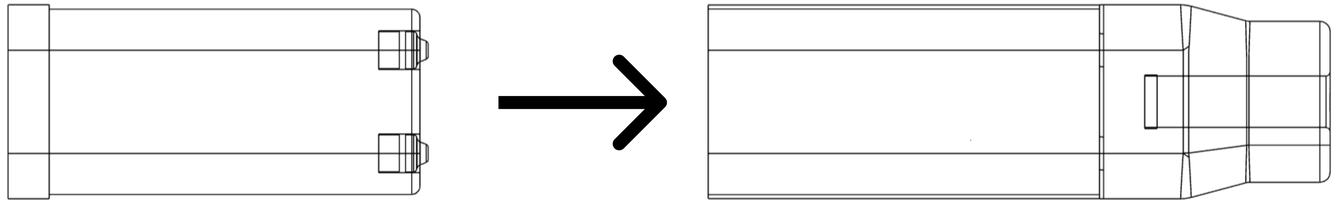
Two part solution:

Disposable (and recyclable) part:
- Contains the e-liquid along with the heating element and electrical contacts.
- Branded casing made with PLA for recycling.

Rechargeable part:
- Contains the battery, pressure sensor and signal LED.
- Casing made with aluminum and rubber.

Reference:

For designing the two parts, DRAGBAR was used as a reference. It uses a ceramic pad



Rechargeable battery element

Disposable element



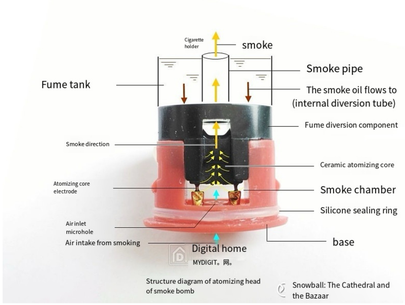
The rechargeable lithium polymer (maximum energy density) battery is incased in an aluminum shell to ensure it has a long lifespan without being too heavy. It also increases the safety as provides a layer of protection from the battery getting pierced.

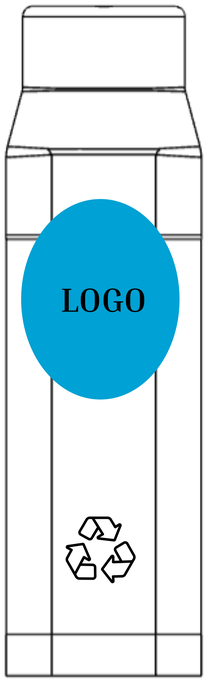
Spring loaded contacts are used to electronically connect the two parts. The correct polarity can be obtained by the machine reading the barcodes.

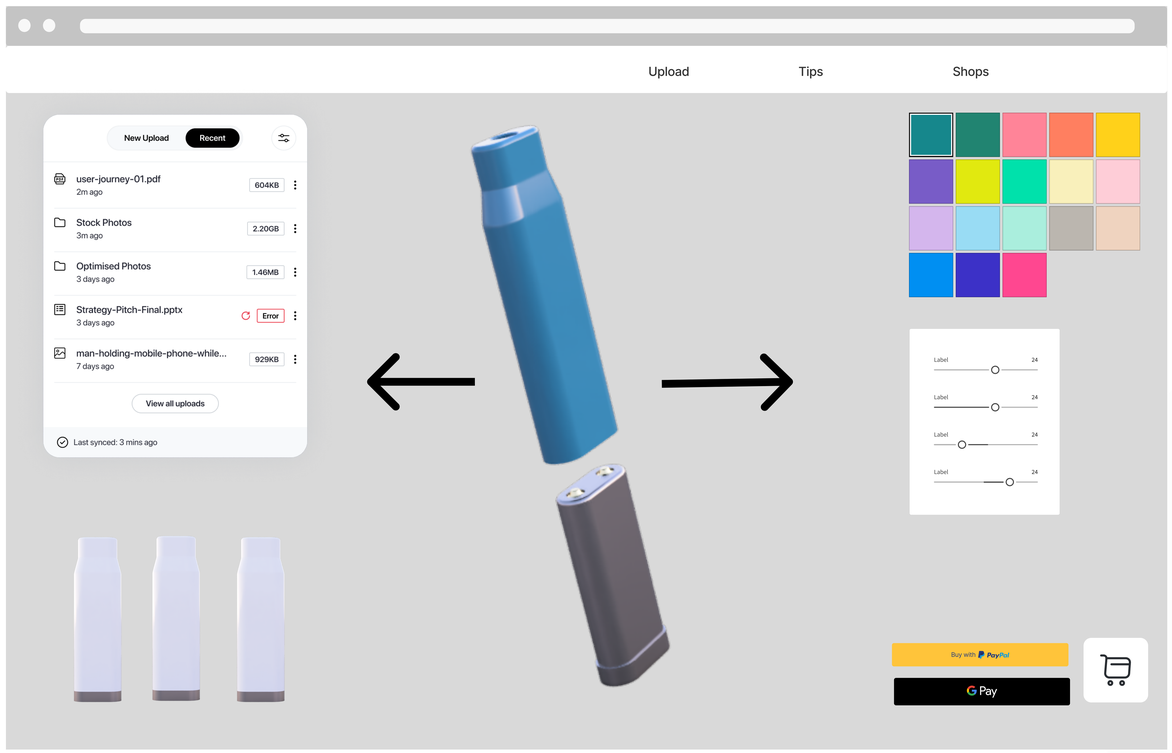
E-liquid is stored in the within the the disposable PLA shell. This was decided as it is difficult to refill the e-liquid without contamination.

The PLA is recyclable which makes it a good choice. It comes in lots of different colours and can be easy branded with stickers and embossing.

PLA can also be downcycled to other products if past the point of recycling.



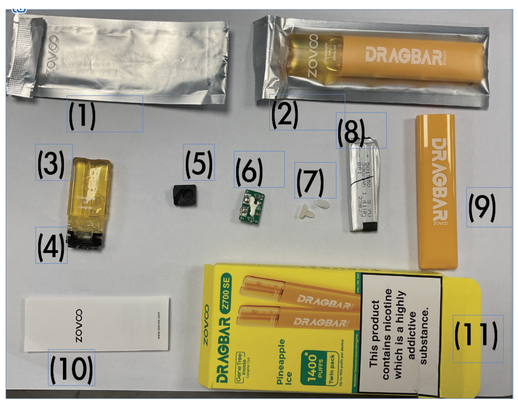




Colour picking from selection of PLA options.



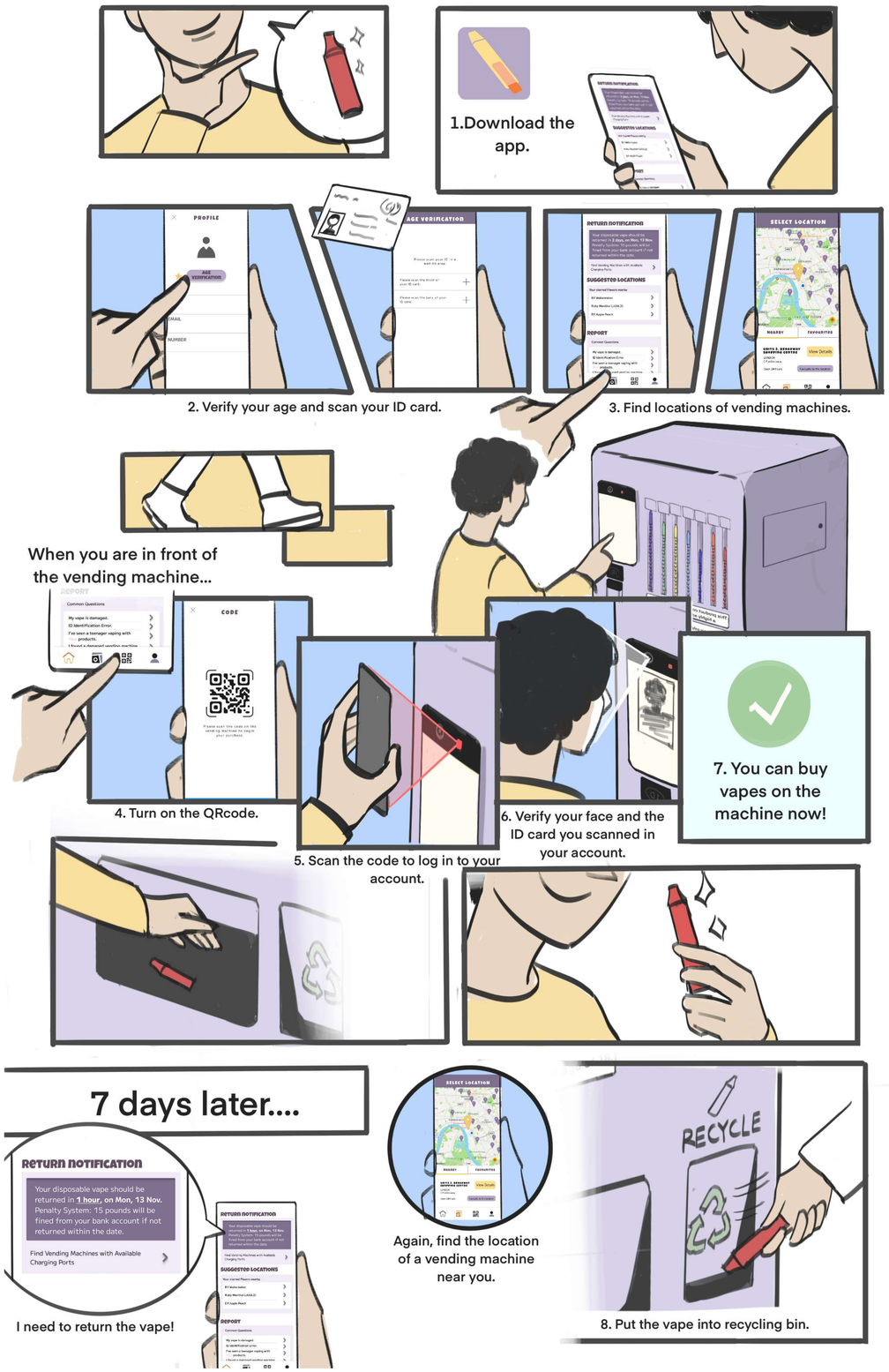




Upload window allows the vape company to upload branding material in image format and place it on the vape in restricted locations.

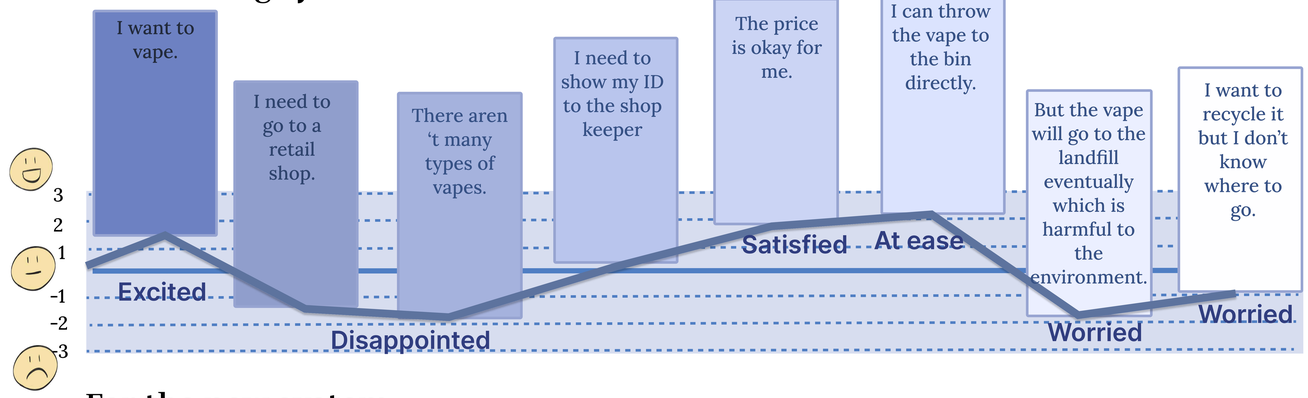
Bulk orders will be possible depending on the vape companies size and how much e-liquid they are able to ship. By purchasing there is an expectation that on delivery of their e-liquid, we should have their designed vapes within the vending machines and selling within a set timeframe.

STORYBOARD

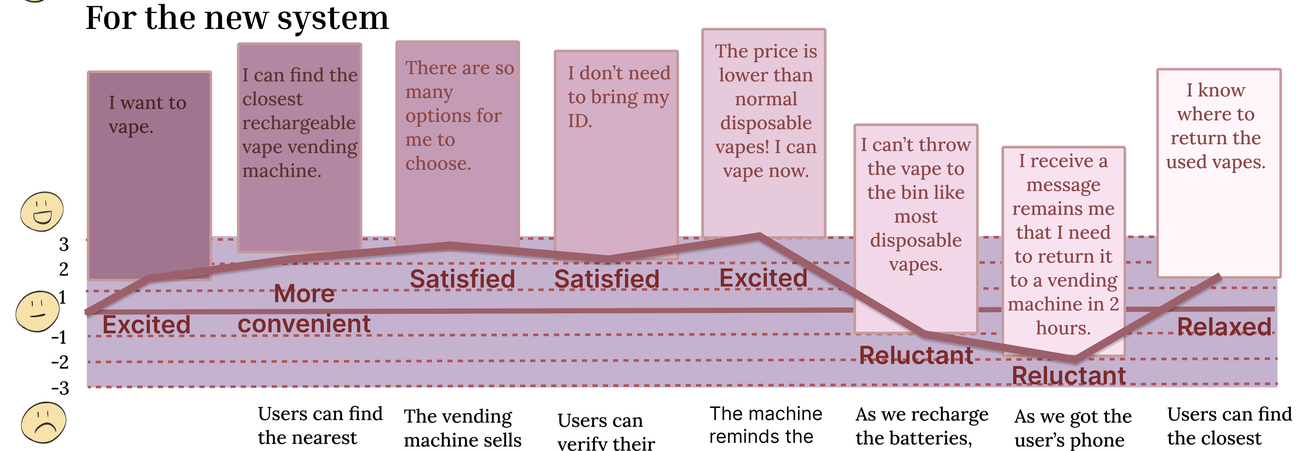


USER JOURNEY MAP

For existing system



For the new system



Users can find the nearest vending machine using the app.

The vending machine sells vapes of lots of flavours from different brands.

Users can verify their age in advance on the app.

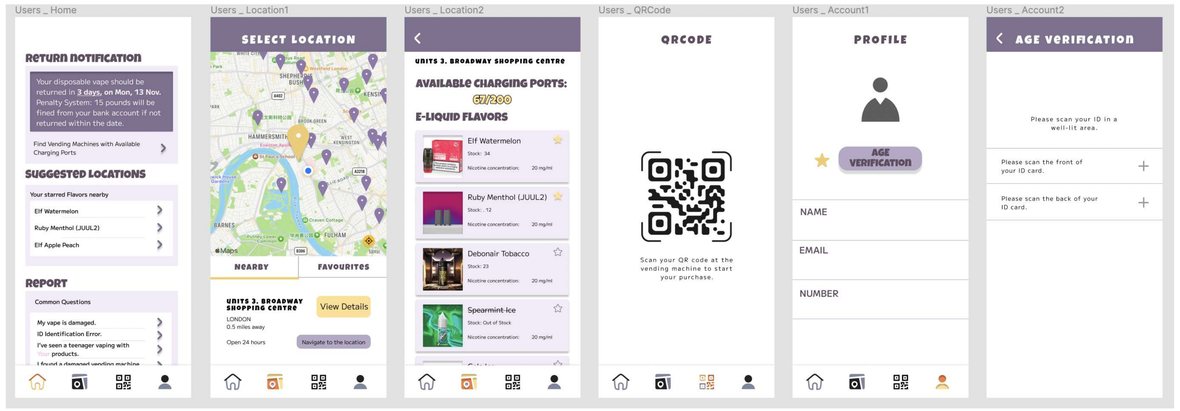
The machine reminds the users that they need to return vapes back before the users are going to pay for them.

As we recharge the batteries, cost of our vapes are relatively cheaper. The price is less than usual vapes.

As we got the user's phone number, we can remind users to return the vape when the time limit is getting close.

Users can find the closest vending machine to return the vape. They can put the vapes back to the charging holes.

USER APP PAGES



ENVIRONMENTAL IMPACT - ECO AUDIT

Assumptions:

- The battery can last 300 recharge cycles .

transport comparison

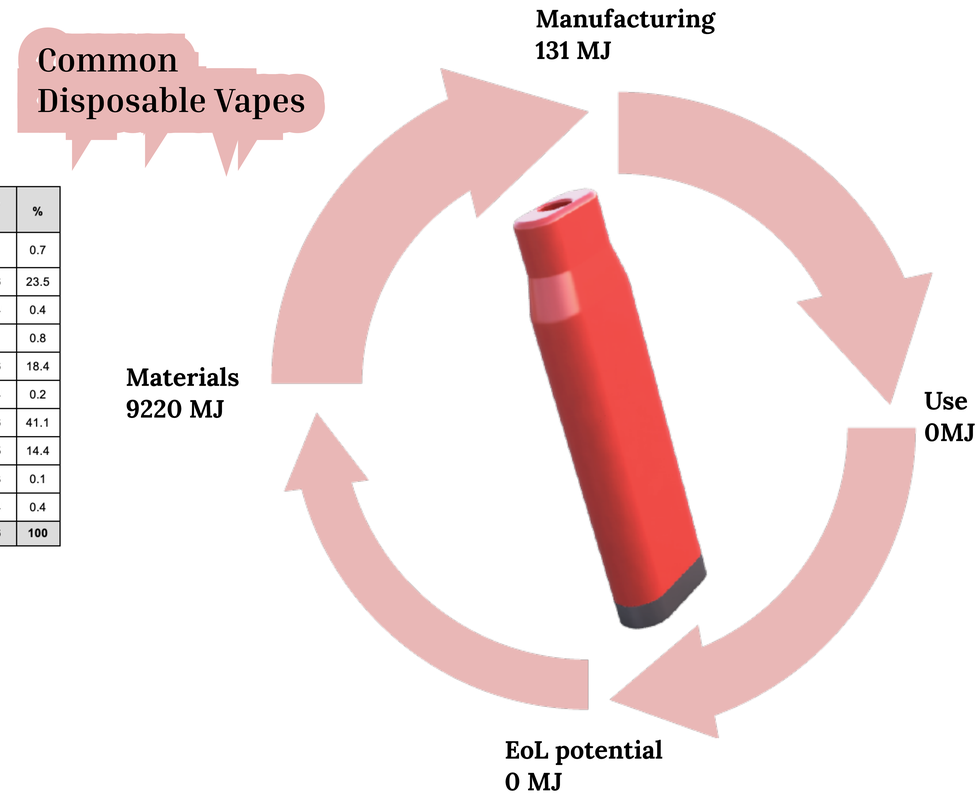
Common brands are produced in Shenzhen, China and shipped to the UK, resulting in a significant carbon footprint and lack of recycling for new production. The transport consumption was 7x10^3 J .
Combivape, on the other hand, manufactures its products locally in the UK. The energy consumption of transportation is now 119 J per vape.

Battery Comparison

Regular disposable vapes typically have batteries that are landfilled after a single use. In contrast, Combivape's approach involves reusing batteries up to 300 times, followed by recycling for new battery production.

Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (J)	%
Internal package	Non age-hardening wrought Al-alloys	Virgin (0%)	0.0001	2	0.0002	4e+04	0.7
Mouthpiece	Polycarbonate (PC)	Virgin (0%)	0.0065	2	0.013	1.4e+06	23.5
Silicone plug	Silicone elastomers (SI, Q)	Virgin (0%)	0.0001	2	0.0002	2.5e+04	0.4
Silicone piece	Silicone elastomers (SI, Q)	Virgin (0%)	0.0002	2	0.0004	5e+04	0.8
Small circuit board	Integrated circuit, small	Virgin (0%)	0.0003	2	0.0006	1.1e+06	18.4
Small Silicone plug	Silicone elastomers (SI, Q)	Virgin (0%)	5e-05	2	0.0001	1.2e+04	0.2
Battery	Li-Ion AA cell battery	Virgin (0%)	0.006	2	0.012	2.4e+06	41.1
Vape pod	Polycarbonate (PC)	Virgin (0%)	0.004	2	0.008	8.4e+05	14.4
Instruction	Paper and cardboard	Virgin (0%)	0.0002	1	0.0002	5.6e+03	0.1
Outer package	Paper and cardboard	Virgin (0%)	0.0008	1	0.0008	2.3e+04	0.4
Total				**18**	**0.036**	**5.8e+06**	**100**

Phase	Energy (J)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	5.84e+06	86.9	0.392	88.2
Manufacture	3.01e+05	4.5	0.0226	5.1
Transport	7e+03	0.1	0.000504	0.1
Use	5.62e+05	8.4	0.0284	6.4
Disposal	1.08e+04	0.2	0.000756	0.2
Total (for first life)	**6.72e+06**	**100**	**0.445**	**100**
End of life potential	-1.4e+06		-0.0775	

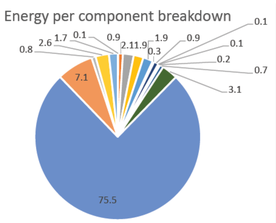


Energy

As seen, the lithium polymer battery and other small contol elements are responsible for over 80% of the embodied energy of the product.

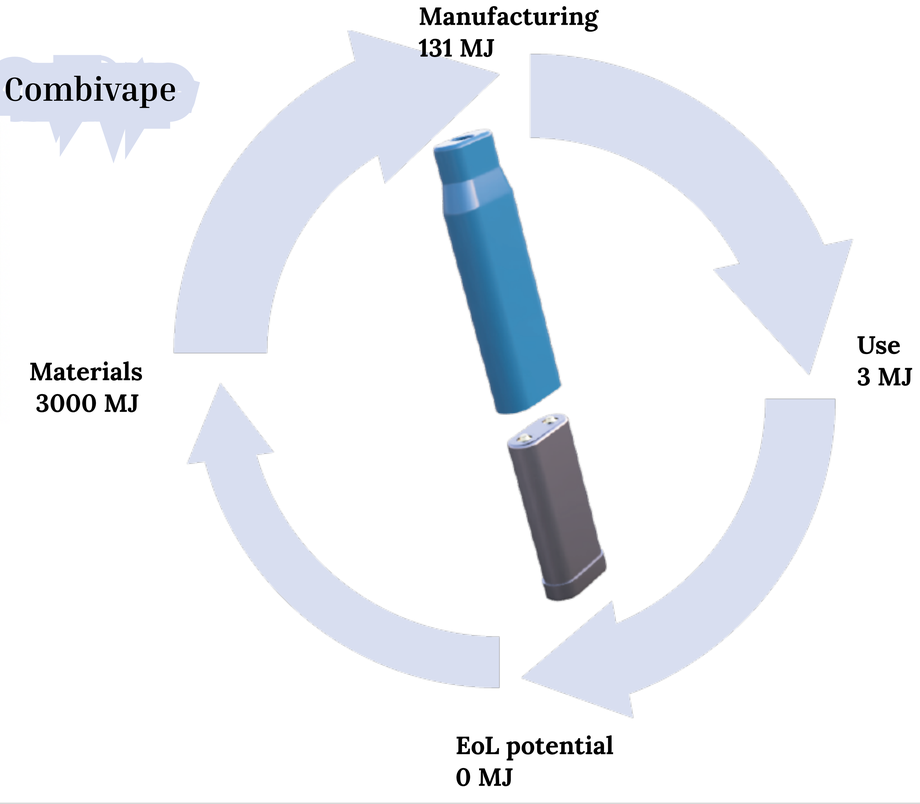
Assumptions:

Some materials and processes (for example the E-liquid) were not available in Granta Edupack so appropriate substitutions were made.



Component	Material	Recycled content* (%)	Part mass (kg)	Qty.	Total mass (kg)	Energy (J)	%
Internal package	Aluminum alloys	60.0%	0.0002	2	0.0004	3.9e+04	2.1
Mouthpiece	Polycarbonate (PC)	80.0%	0.013	2	0.026	1.3e+06	70.7
Silicone plug	Silicone elastomers (SI, Q)	Reused part	0.0002	2	0.0004	0	0.0
Silicone piece	Silicone elastomers (SI, Q)	Virgin (0%)	0.0004	2	0.0008	9.9e+04	5.4
Small circuit board	Integrated circuit, small	Reused part	0.0006	2	0.0012	0	0.0
Small Silicone plug	Silicone elastomers (SI, Q)	Reused part	0.0001	1	0.0001	0	0.0
Battery	Li-Ion AA cell battery	Reused part	0.012	1	0.012	0	0.0
Vape pod	Polycarbonate (PC)	80.0%	0.008	1	0.008	4e+05	21.8
			0.0008	1	0.0008	0	0.0
Total				**14**	**0.05**	**1.8e+06**	**100**

Phase	Energy (J)	Energy (%)	CO2 footprint (kg)	CO2 footprint (%)
Material	1.83e+06	61.6	0.103	60.9
Manufacture	3.11e+05	10.5	0.0233	13.8
Transport	119	0.0	8.59e-06	0.0
Use	8.04e+05	27.0	0.0406	24.1
Disposal	2.7e+04	0.9	0.00189	1.1
Total (for first life)	**2.97e+06**	**100**	**0.168**	**100**
End of life potential	-5.97e+05		-0.0332	



VENDING MACHINE INFRASTRUCTURE

Christian Grose

Overall vision:

The vending machine goal is for the user to be able to have the same (if not better) experience as buying a disposable vape. This means making it intuitive and simple to use.





Design:

After looking at different options, we decided that the machine should be similar to a standard food/drink vending machine.

- They are the right scale for storing an appropriate amount of vapes.
- They are designed to fit in lots of different retail environments - **the infrastructure is already there.**

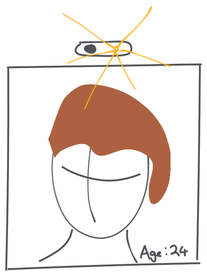
ID checking

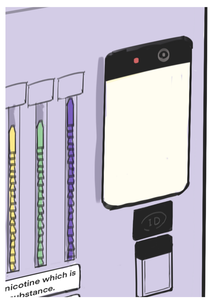
In order to emulate the standard ID checking process at stores, a effective system would need to be used.

By signing into the app and linking it to the vending machine, the responsibility of ID checking is off-loaded onto the app. This can be achieved by 3rd party services.

If the user does not have a verified account on the app a camera image recognition age check is run. Technology is at a state where it can be ascertained to be accurate to +-4.5 years.

Should the user fail that, their ID will be scanned by the camera to check its authenticity and date. Face ID can then be used to check the against the person in real life.







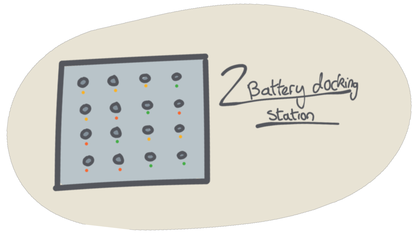
Possibilities of using existing infrastructure.

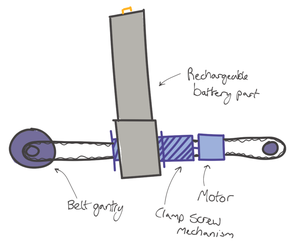
Recharging batteries in a vending machine format is an existing technology. Self-service phone chargers use this.

For recharging the battery parts they will be in array in a docking station. This will work in a similar way by monitoring the charge status of all devices in order to efficiently managed the batteries.

Taking inspiration from existing vending machines inspired the assemble/ disassembly mechanisms explained on the next page.





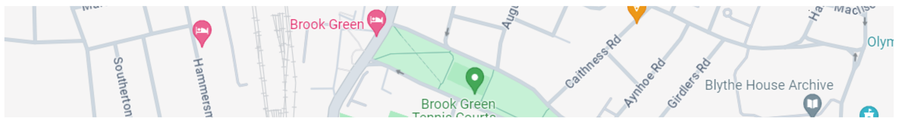




Branding and competition between vapes

Vending machines inherently introduce a level of competition for products within them. In the interests of fairness.

Strategic placement is paramount for vending machine brands. Locating vending machines in high-traffic areas, such as offices, schools, and public spaces, increases visibility and exposure to potential customers. Carefully considering factors such as customer demographics, foot traffic patterns, and complementary businesses can help optimize placement for the brand.



VENDING MACHINE INFRASTRUCTURE

Christian Grose

Standard vape packaging requirements

Functional requirements:

- Stackable for transport and display.
- Protects the product inside from impacts.
- Legally has to indicate the nicotine content.
- Showing product & flavour.
- Authenticity check.

Soft requirements:

- Brand recognisation.
- Fitting into the retail environment.
- Enticement factor.





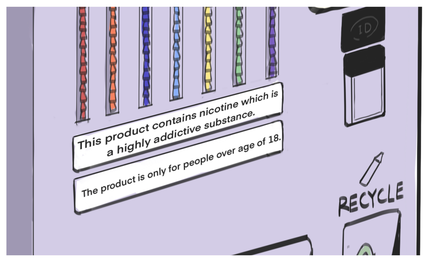
Packaging adapted for the vending machine

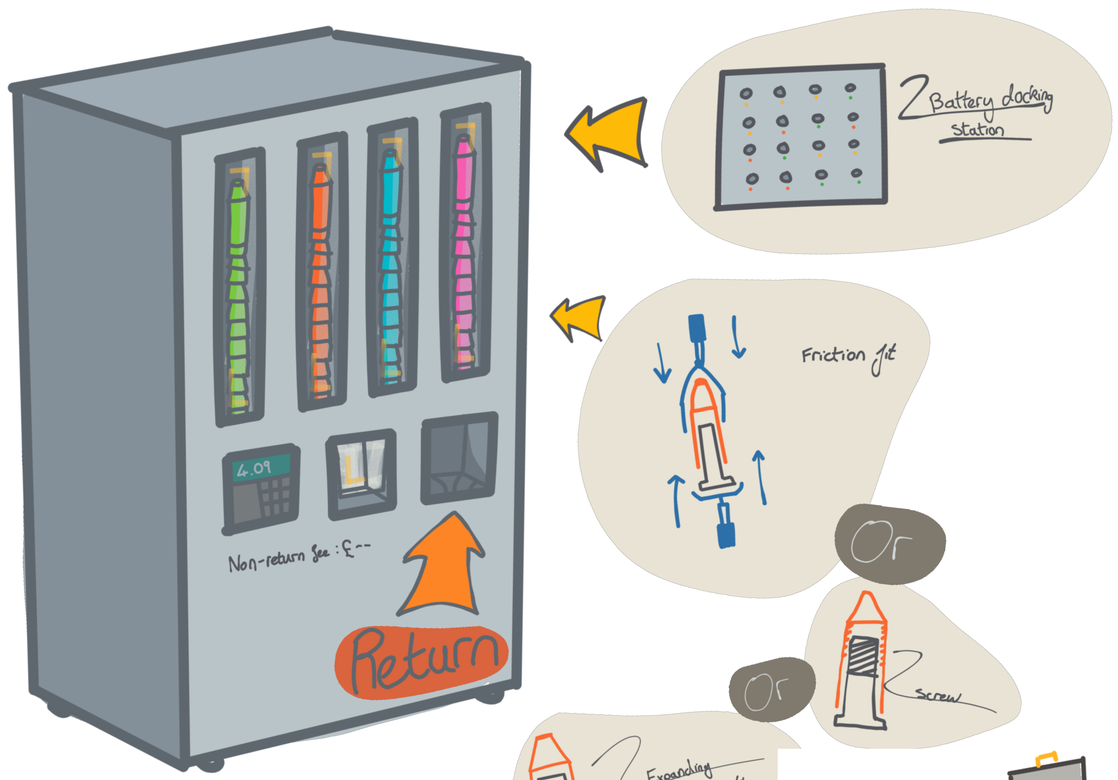
Functional requirements:

- Disposable parts stackable for transport and display.
- Protects the product inside from impacts.
- Shows nicotine content on the machine (see below)
- Showing product & flavour.
- Authenticity check through barcode on disposable part

Soft requirements:

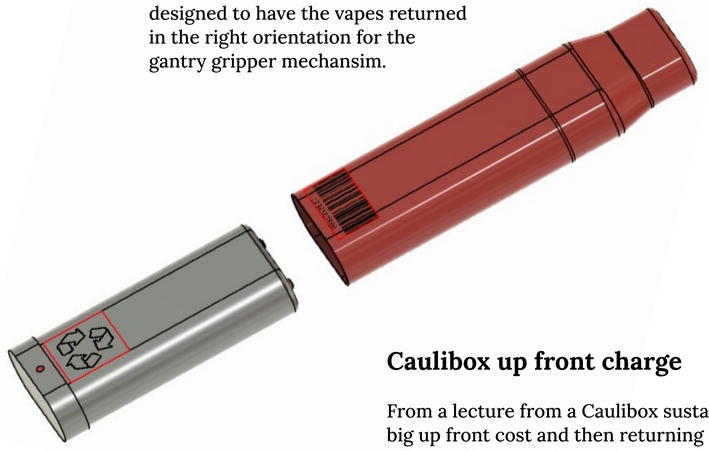
- Branding built through shell .
- Fitting into the retail environment.
- Enticement factor.





Returns

The returns slot in the machine is designed to have the vapes returned in the right orientation for the gantry gripper mechansim.



Caulibox up front charge

From a lecture from a Caulibox sustainability expert, it was stressed that that charging a big up front cost and then returning it later after the product is returned was not as effective for engaging consumers.

Therefore for our payment infrastructure we would use a small initial charge for renting the vape which then enters the user into a contract to pay more on non-return. A delayed payment like how TFL uses a £0.1 card payment before charging more later.

Vape assembly/disassembly

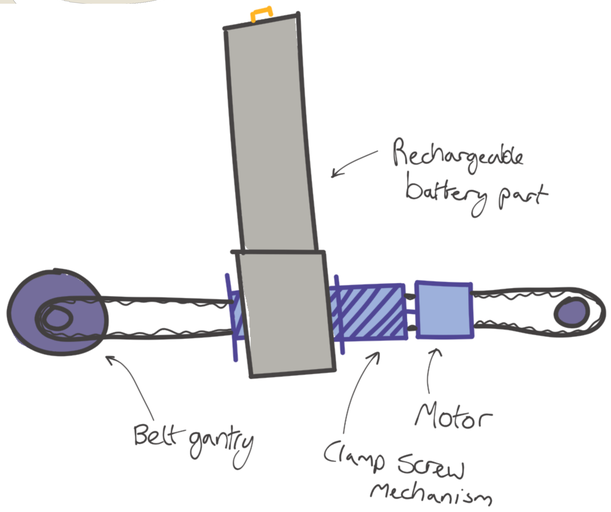
Lots of methods for assembling the disposable and rechargeable element were considered.

Specifications:

- Repeatability
- Accuracy
- Ease for the machine vs difficulty for the user to take apart. The user should not be able to take it apart for safety reasons.
- Feasibility
- Low cost on the disposable side

1. Friction fit
   a. Effective at joining
   b. Less effective over time
   c. Low cost
2. Screw
   a. Easy for the user to take apart.
   b. Difficult to align screw threads within the machine.
3. Expanding pressure fit
   a. Low feasibility
   b. High accuracy and repeatability
   c. High cost

It was decided that the pressure fit solution would be the most effective due to it's simplicity and low cost nature.



The gantry system works like a 3D printer using stepper motors to move the battery parts around in XYZ.

A motor ball screw mechanism can then be used to hold on to the parts with enough force to create the friction fit.

XYZ movement allows for multiple levels of docking stations within the vending machine to ensure a fully charged module is always ready to be combined with the disposable element.

Inventory Management:

The inventory management mechanism is the part of the vending machine that tracks product levels and alerts the operator when products need to be replenished. This can be done using RFID tags, sensors, or a combination of both. The inventory management mechanism should be accurate and reliable, and it should also be able to handle a variety of product types. For this machine it makes sense for it to be accomplished by scanning the barcodes on the both parts that are already there for data collection.

DATA ARTIFACTS

Qinxuan Li

Combivape is responsible for creating all artifacts and continuously monitors and analyzes data to optimize the vape vending system.

In the Data and Actors page, not all actors, like regulatory bodies and environmental agencies, are elaborately covered as their roles in our business model and the circular economy may be minor. Additionally, the artifacts involved with these less prominent actors are common and lack the innovation worth mentioning.

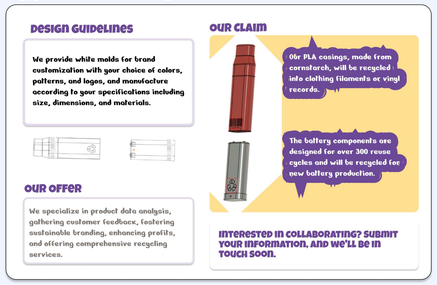
Displayed below are excerpts of UI interfaces, products, and local features of vending machines, offering insights into the operation of the data system. ⬇️

Vape Manufacturers

Design Scheme, Contract

Claims, Resource Info, Impact Data

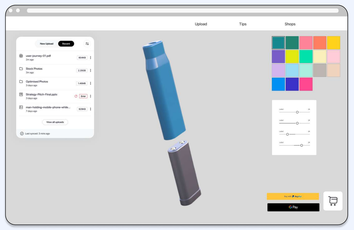
Combivape offers a scheme with size, material, and design guidelines for brands to customize case colors and patterns. Features include product analysis, sustainable branding, and recycling services, with a recycling and reusing promise of the products.



Casing Personification

Product Info, Brand Info

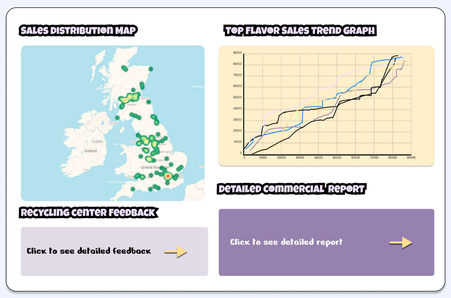
A dedicated web page allows brands to customize their vape casings with unique colors and patterns. Final designs are sent to Combivape for manufacturing and then delivered to the brand's facilities for E-liquid filling.



Business Report

Customer Data, Resource Info, Instructions

For participating brands, Combivape generates business reports featuring sales distribution maps, recycling feedback, design evaluations, and best-selling flavor trends. Vape manufacturers receive monthly sales reports online for detailed market analysis and product improvement.

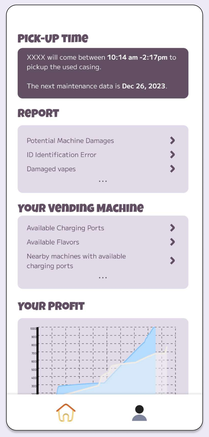


Retailers

An APP for retailers

Location & Product Data

A phone app to report vending machine damages, help customers find specific vape flavors, locate nearby machines for available batteries, and gain business insights (show profit growth).



Products

1 Casing Barcode

Resource Info

Information about brand, flavors

2 Battery Barcode

Resource Info

Provides battery ID for tracking usage cycles and condition.

3 LED Light

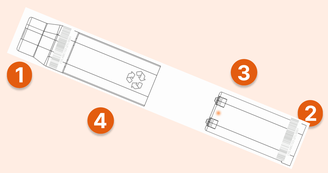
Resource Info

Lights up during use, blinks to signal low battery or damage."

4 Embossed recycling mark

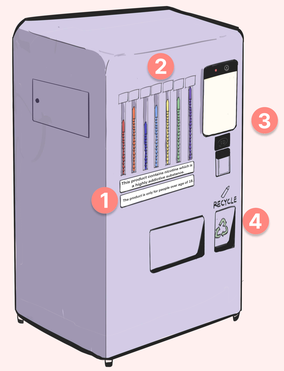
Claims

Show users the products are recyclable.



Infrastructure

Vending Machine



1 Nicotine & Age Warning

Resource Info

2 Flavors

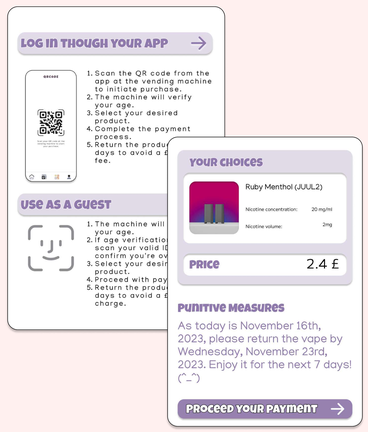
Resource Info

Showcases product appearance, brands and stock quantity.

3 Touch Screen & Camera

Resource Info, Instructions, Claims

Display rental instructions, verify user age (over 18), check account, and list available vape flavors.



4 Recycling Symbol by the Return Port

Claims

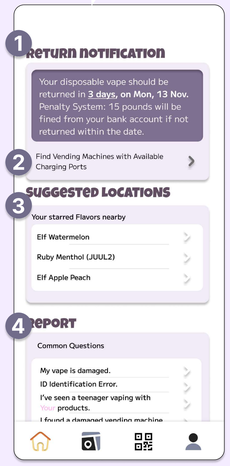
Signifies commitment to recycle returned vapes.

Users

An App for users

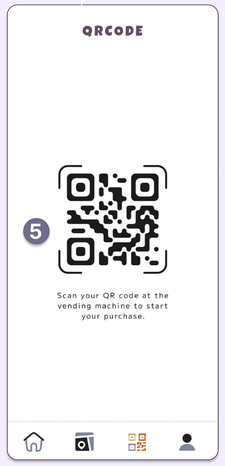
Home Interface

Customer Data



QRcode Interface

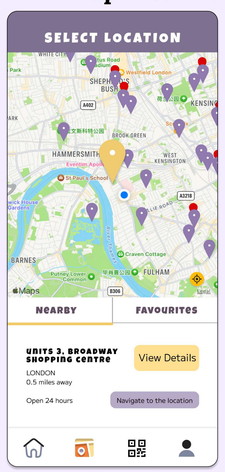
Customer Data



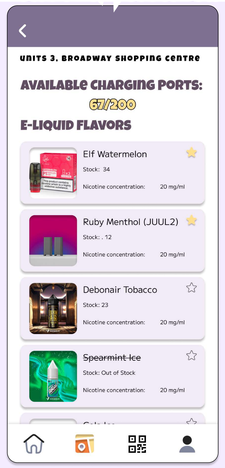
1. Return Notification
2. Nearby return location
3. Suggested vending machine location based on users' prefered e-liquid flavors
4. Common report questions shown
5. Instruction on how to log in to the vending machine

APP Map Interface

Location & Product Data



Vending Machine locations:
Link to Map app for navigation



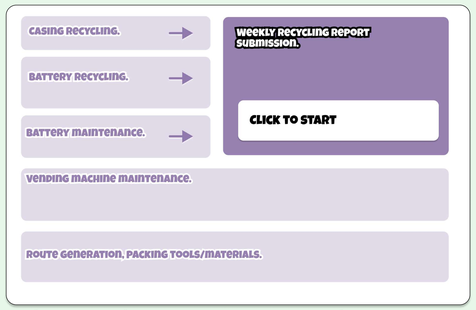
Show Detailed resource info of a specified machine:
Available charging ports and e-liquid flavors.

Recycling Center

Vape Recycling Center Dashboard

Location Data & Resource Info

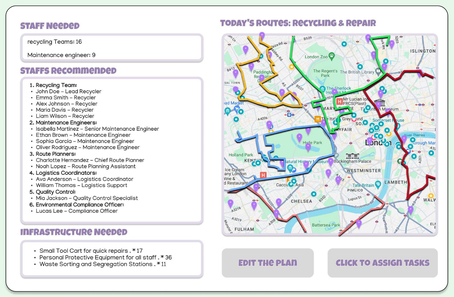
Tracks casing and battery recycling, maintains vending machine schedules, and compiles weekly usage and durability reports for design improvements. Also assists in planning collection routes for used casings.



Recycle & Maintenance Route Planner

Location, Staff, and Infrastructure Data & Resource Info

An adaptive dashboard that automatically assigns tasks to recycling staff and maintenance engineers based on the quantity of used casings, batteries for recycling, and vending machines needing repair, featuring a color-coded map for route planning and staff management.



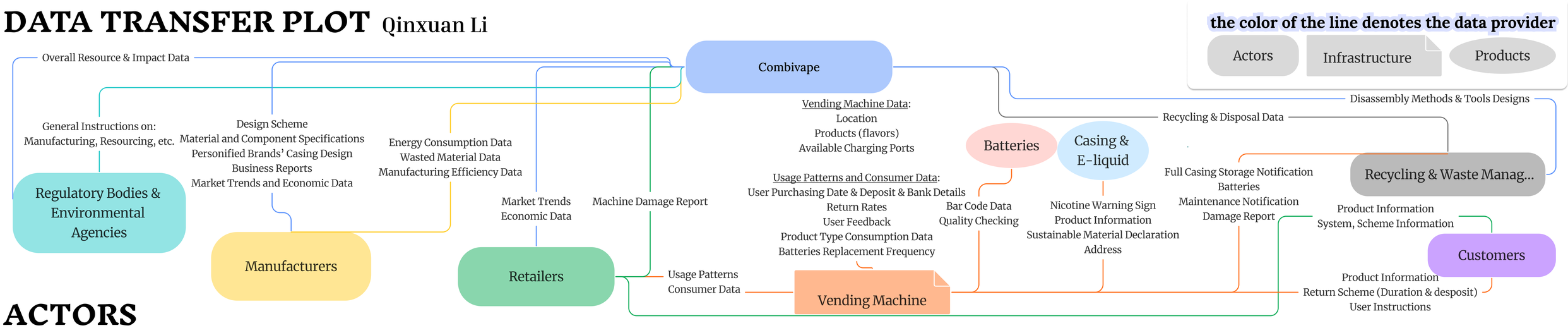
Recycling Truck

Impact Data, Claims

The truck showcases recycling, Combivape, and collaborating Vape brand logos, with the slogan "Powering Sustainability: Recharging Batteries, Reinventing Casings," highlighting our commitment to battery reuse and PLA casing recycling.



DATA TRANSFER PLOT Qinxuan Li



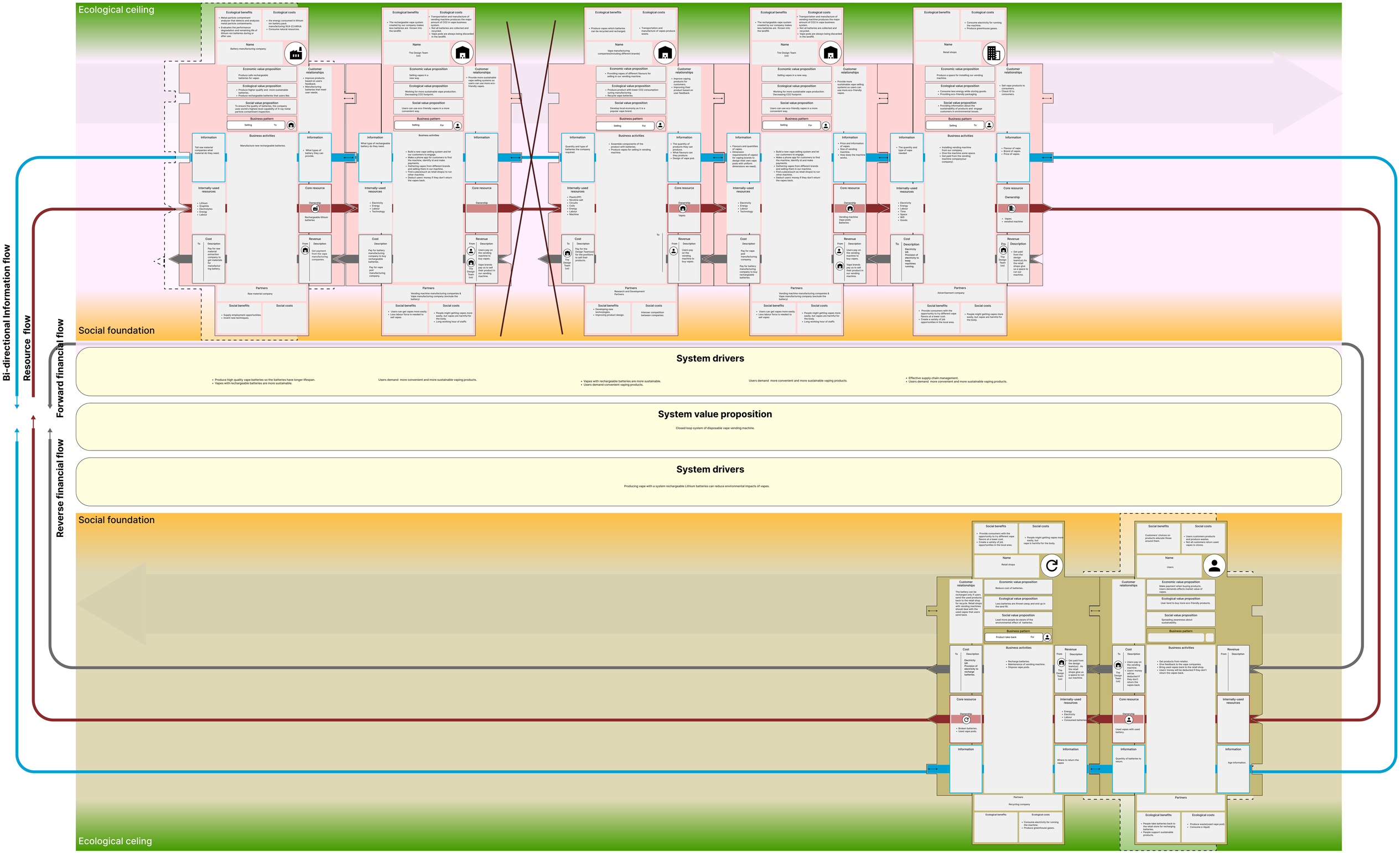
ACTORS

	Recycling and Waste Management Entities:	Distributors and Retailers:	Manufacturers	Regulatory Bodies and Environmental Agencies	Consumers
Awareness	• Recognize that most customers do not recycle disposable vapes and that many disposable vapes are not efficiently disassemblable. • Aware of environmental regulations and the latest recycling technologies.	• Acknowledge the environmental concerns of disposable vapes and the lack of recycling by most customers.	• Conscious of the environmental impact caused by disposable vapes, especially the single-use consumption of lithium batteries.	• Understanding of the environmental impact of vape products and the importance of sustainable design and recycling in reducing ecological footprints.	• Aware that disposable vapes cause large unnecessary single consumption of lithium batteries.
Interaction	• Recycle batteries, casings, and machines from retailers; • Receive and process reports from retailers; • Advise on material selection during manufacturing; • Transport used casings and malfunctioned batteries; • Return recycled materials to suppliers and manufacturers.	• Acquire vending machines and batteries from Combivape; • Stock Casing&E-liquid from various vape brands; • Utilize business data analysis from the Design Team's Database; • Report potential damages to design teams.	• Align product production with the Combivape's database insights; • Create products adhering to the Combivape's sustainable schemes; • Distribute vapes based on consumption pattern; • Manage customer deposits and refunds for product returns.	• Collaborate with Combivape on eco-friendly designs; • Advise on material selection; • Manage transportation and recycling of used casings and batteries.	• Buy products from machines in local stores • Register with Combivape to get machine locations (including flavor, brands, available charging ports information), return alerts, deposits notification.
Motivation lever	• Aim to spend less time on disassembly and reduce energy consumption in recycling processes; • Utilize a convenient database system to manage stores' recycling requests.	• Reduce time spent on storage, product searching, and cashiering; • Enhance product and purchasing flow.	• Gain better market and customer preference insights; • Reduce the number of components manufactured; • Lower production costs.	• Enhance efficiency in disassembly and recycling; • Use a database system for streamlined recycling requests.	• Lower cost.
Behavior	• Perform routine maintenance on machines; • Collect and recycle used products.	• Retailers supervise consumption, maintain hygiene, and educate customers about the machine system. • Distributors install machines in populated areas based on demographic analysis.	• Design unique casings and flavors; • Handle manufacturing and distribution.	• Oversee transportation, disassembly, and recycling of used products.	• Choose, Buy products with deposits included. • Vape. • Return to the machines and get deposits back if vape is not damaging or missing parts.
Experience	• Find satisfaction in the convenience and ease of disassembly processes.	• Initially overwhelmed with building customer awareness, but eventually pleased with profitable operations requiring minimal effort.	• Satisfaction in contributing to sustainability, though challenged by the need to adhere to strict design schemes.	• Happy: Aim for ease and efficiency in disassembly and recycling processes.	• Overwhelmed and feel complex at first, then become pleasant.
Trait	• Pioneers and advocates for the progression of the vape industry's circular economy.	• Pioneers in the vape industry with an environmentally-friendly image.	• Cultivate an environmentally-friendly brand image; • Ensure products are recognized for high-quality sustainability.	• Diligence in enforcing environmental standards and a proactive approach in encouraging sustainable practices in the industry.	• Trendy among vapers. • Environmental-friendly image.
Actors' Insights	"Combivape's database simplifies our route planning for recycling pickups. Their product designs are also easier for us to disassemble and recycle."	"We don't have to bother with WEEE registration or compliance. We just provide space for the vending machine, which handles everything, allowing us to earn effortlessly."	"We focus on providing E-liquid instead of manufacturing vapes, reducing our effort while increasing profits and enhancing our sustainable image."	With more retailers complying with WEEE and customers being over 18 and returning vapes, we're seeing a positive trend. This might even halt plans to ban disposable vapes.	"We spend less yet still enjoy the zero-maintenance, draw-activated disposable vapes and contribute to a sustainable vaping economy."

THE VALUE NETWORK

For manufacture and reuse of vapes' rechargeable batteries. Done by *Miaoyan Tang*

-The Design Team(us) appears twice as we collaborate with more than one companies.
-Retail shop appears twice as they are responsible for both vape selling & vape recycling.



RISKS & OPPERTUNITIES

For manufacture and reuse of vapes' rechargeable batteries. Done by *Miaoyan Tang.*

	Revenue benefit	Cost	Cost mitigation
Finances	• Get payment from the vape manufacturing companies. • Users pay on the vending machine to buy vapes. • Get users' payments on the vending machine. • Get paid from the vending machine company(our company). As the retail shops give us a space to run our machine. • Pay for vape pod manufacturing company.	• Pay for raw material extraction company to get materials for manufacturing battery. • Pay battery manufacturing company to buy batteries for vapes. • Pay for the vending machine company for the positions to sell their products. • Buying vapes from different vaping companies for selling in our vending machine. • Users pay on the vending machine. • Users' money will be deducted if they don't return the vapes back. • Electricity bill. Provision of electricity to recharge batteries.	• The Battery manufacturing company buy **cheaper raw materials**. • Vending machine company **educate customers** to not destroy batteries. • Users return vape to retail shop. • Vape production company should choose **cheaper batteries** to use.
Ecology	• Metal particle contaminant analyzer that detects and analyzes metal particle contaminants. • Evaluates the performance degradation and remaining life of lithium-ion batteries during or after use. • Produce vapes which batteries can be recycled and recharged. • The rechargeable vape system created by our company makes less batteries are thrown into the landfill. • People take batteries back to the retail store for recharging batteries. • People support sustainable products.	• The energy consumed in lithium ion battery pack manufacturing:16.8–22 kWh/kg. • Consume natural resources. • Transportation and manufacture of vapes produce waste. • Transportation and manufacture of vending machine produces the major amount of CO2 in vape business system. • Not all batteries are collected and recycled. • Material in battery cause land degradation. • Vape pods are always being discarded in the landfill. • Consume electricity for running the machine.Produce greenhouse gases. • Produce waste(used vape pod). • Consume e-liquid.	• Battery manufacturing company can utilize **energy-efficient equipment and machinery**. • Vape manufacture company find battery manufacture company in **local area** to reduce shipping consumption. • Vaping manufacturing company and vape vending machine company educate customers and encourage more customers to take the vape to recycling points. • Vape pods might can be **recycled and reused**.
Society	• Supply employment opportunities. • Developing new technologies. • Improving product design. • Users can get vapes more easily. • Less labour force is needed to sell vapes. • Create a variety of job opportunities in the local area. • Customers' choices on products educate those around them.	• Intenser competition between companies. • Long working hour of staffs. • People might getting vapes more easily, but vapes are harmful for the body. • Users customers products and produce wastes. • Not all customers return used vapes to stores.	• Vape manufacturing company induce **more machine** to help staffs. • The vape brands remain users **how vaping effects their health**. Such as respiratory problems and nicotine addiction.