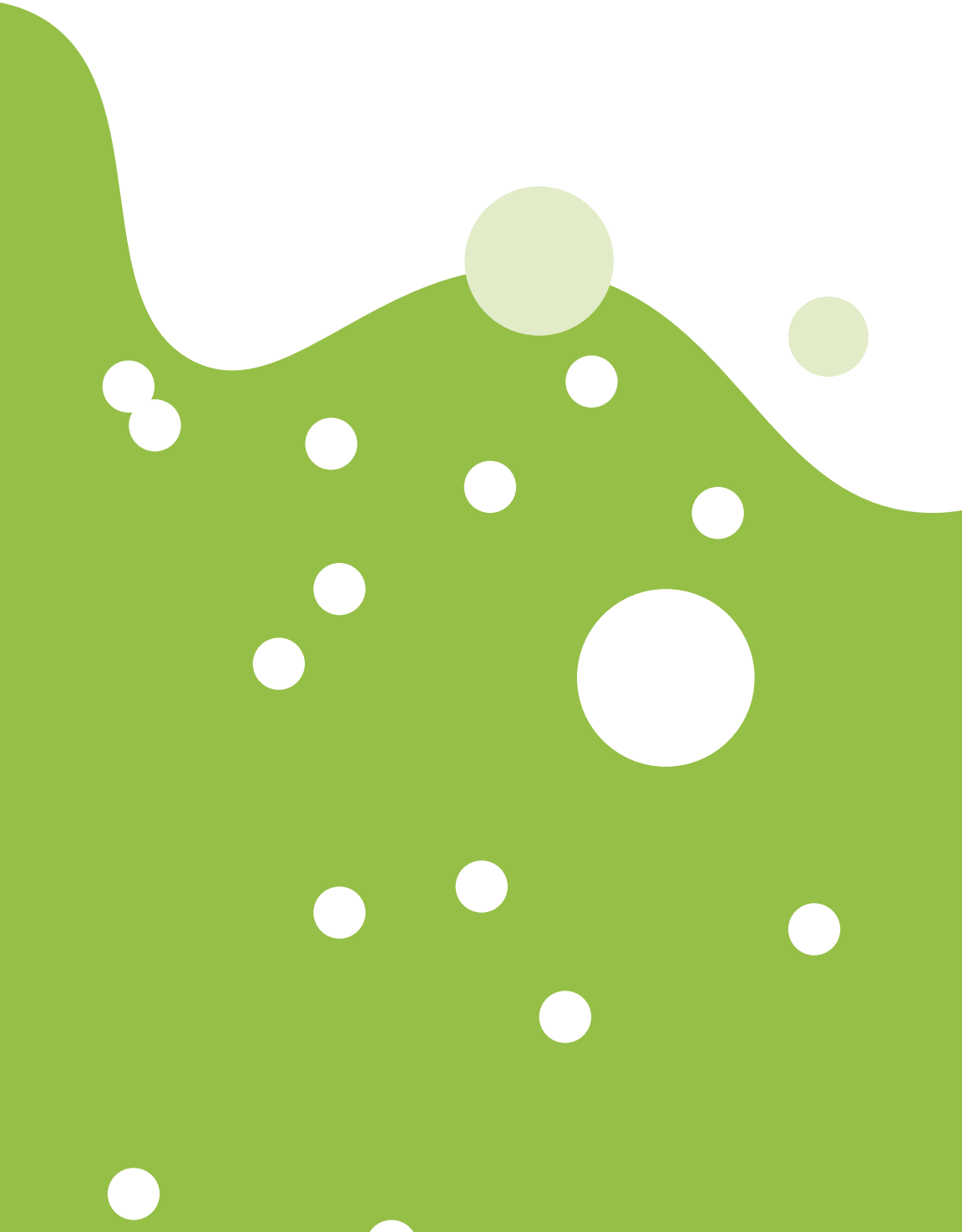




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CARBON DIOXIDE POLLUTION IN SOFT DRINKS INDUSTRY

"Carbon dioxide is a natural and harmless greenhouse gas. However, adding more and more CO₂ to the atmosphere could cause global warming. Carbonated drinks contain CO₂ to make them fizzy and extend their shelf life. Nevertheless, there is a significant amount of carbonated drinks being consumed around the world every day, which will have a huge impact on the environment."



RESEARCH PAPER

Soda is a popular choice of drink consumed globally. Soda could easily purchase anywhere, like supermarkets, school, hospital, even drug stores such as Walgreen, CVS. Basically, any place selling water will also sell soda. However, soda has a significant impact on the environment that 230 million tons of carbon dioxide released annually into our atmosphere. The beverage industry alone contributes 3.8% to the global carbon dioxide emissions. Yet, the soft drink production extends beyond its immediate industry, connecting with energy use and transportation, two significant industries responsible for a substantial 53% of the overall greenhouse gas emissions worldwide. Therefore, the soft drink industry contributes more to the carbon

footprint than commonly recognized. As we know, carbon dioxide, also known as CO₂, is a natural component of Earth's atmosphere. It is produced through natural and human activities, such as respiration of plant, animal, human, the combustion for fire or energy, and industrial processes. All of this seems normal, but with the growth of the economy, the industrial industry has been producing nonstop carbon emissions into the air. That is the main factor that leads to a rise in global temperatures, also known as global warming. With the widespread consumption of these carbonated beverages globally is contributing significantly to environmental impact. The use and generation of carbon dioxide in the production of carbonated drinks,

given the substantial size of the carbonated soft drink market, over 410 billion dollars in 2023, as reported by ScienceDirect. Furthermore, Statista highlights that the average annual soft drink consumption per person ranged around 38.87 gallons from 2010 to 2018, with the United States holding the highest soft drink consumption rate in the world. This number of consumptions is raising people awareness of the production and distribution of carbonated beverages. One of the most important processes is carbonation. In this process, carbon dioxide is a process where carbon dioxide is added with water it creates a bubbly texture create a unique mouthfeel that can simultaneously tickle the tongue and produce sensations of sourness and a burn. This

sensation adds to the drink, making it more appealing and enjoyable for customers, especially when thirsty. The refreshing feeling it provides a better drinking experience. This element make soda unique and abroad to a larger range of customer. From the research, ScienceDirect's data indicates that a typical carbonated soft drink contains approximately 3–4 volumes (6–8 g/L) of CO₂, providing a quantitative understanding of the scale of CO₂ integration in each beverage. Furthermore, the disclosure that one can of Coca-Cola (330ml) equates to 0.17kg CO₂e, as presented in the same study, exemplifies the amount of carbon footprint associated with a single beverage. Ingredient sourcing and processing is another process that make impact

to the environment. Amienyo et al.'s (2012) life cycle assessment of carbonated soft drinks, published in Springer, provides a comprehensive view of the ecological consequences associated with the ingredients used in these beverages. Particularly, sweeteners like high-fructose corn syrup, a common component in soft drinks, contribute to emissions during cultivation and processing. The carbon footprint of corn, a primary source for sweeteners, is reported at 0.27kg CO₂ per pound of produce, highlight the environmental cost associated with this key ingredient. Additionally, the data shows that a footprint of 1.1kg CO₂ per kg at the factory for high-fructose corn syrup. From the example above, Coca-Cola's emission is 0.17kg CO₂e, compare to corn

syrup's emission is 1.1kg CO₂, corn syrup production produce way more CO₂ compared to carbonation process. This information showing that other industry contributing to the beverage making has higher carbon emission that damaging the environment. The next step is packaging. Common materials such as plastic, glass, aluminum, and carton are used in the packaging of these beverages, each with its own set of environmental impacts. According to the International Energy Agency, the container and flat-glass industries emit over 60 megatons of CO₂ per year. In particular, single-use glass bottles exhibit the highest carbon footprint compared to other packaging types. The carbon footprint of a 12oz glass bottle is over six times

higher than that of a 16oz aluminum can, as reported by Ball Corporation. Furthermore, individual packaging materials contribute significantly to the overall carbon footprint, with a plastic water bottle recording about 828g CO₂, while an aluminum can has a footprint of 96.8g CO₂, with 73% recycled content and 50.4% end-of-life recycling. Despite the fact that glass production produces the most carbon footprint, recycling glass bottles is a better choice for a drink package. It has excellent attributes in most areas like recyclability, refill ability, shelf life, and shape retention. This material choice helps minimize costs and ecological footprints for the production process. However, weight is the limiting factor that affects its use, requiring more energy, cost, and processes for shipping and collecting bottles from users back to the factory. Therefore, aluminum cans and plastic bottles remain the best choices for beverages, as evidenced by their predominant presence in most stores; glass bottle beverages don't even take up half of the beverage section. The production of soft drinks requires significant energy consumption and transportation, contributing to the



industry's overall environmental footprint. As revealed by Abu-Reidah's (2019) exploration of carbonated beverages on ScienceDirect, the carbonation process itself demands substantial energy inputs. In order to initiate the manufacturing process, raw ingredients often need to be transported from various locations to meet the specific requirements of the drink being produced. Sometimes, these ingredients must be imported from different countries to acquire the

exact elements required. International transportation commonly occurs through ships or airplanes, both of which entail significant costs in terms of money and energy. Here is an example, according to Universal Cargo, a company that providing shipping service for goods, "Food shipped internationally by sea and air across countries and continents is the most cost-effective way to transport consumable products. Frozen storage and insulated shipping ensure food

reaches its destination quickly and in perfect condition. Some of the largest cargo ships can carry loads of 740 million bananas in 15,000 containers on a single trip. As such, 90% of all trade occurs at sea." Talking about energy, "65% of Coca Cola's total energy consumption is sourced from renewable and clean energy—geothermal, solar, and biomass. In 2021, CCBPI completed the installation of 14,000 solar panels in three of its production plants:

Davao del Sur, Misamis Oriental and Bacolod. A multi-phased, 24,000 solar panel project is currently underway, while many of CCBPI's sites also use geothermal sources for energy use." Despite being a leading company in adopting green energy sources, Coca Cola has not yet achieved 100% reliance on renewable sources. Thus, its outcome impact on greenhouse gas emissions. Refrigeration is another factor; it helps to improve the tasing experience

and product quality and consumer satisfaction. However, this refrigeration process plays an importance role to the industry's overall energy consumption and environmental impact. As the demand for soft drinks escalates, the energy requirements for refrigeration surge proportionally. even though there is a section for beverages on the shelves at room temperature, many supermarkets also have mini fridges near the cashier area. This allows customers to quickly grab and enjoy a cold drink. Mini fridges are commonly found in various locations within the supermarket. Additionally, vending machines selling drinks are another convenient option, with a fridge installed inside to keep drinks always cool. They are available everywhere, whether on the street, at workplaces, or in any other public spaces. they are the great solution for getting a refreshing cold drink, especially on a hot summer day. Additionally, vending machines selling drinks are another convenient option, with a fridge installed inside to keep drinks always cool. They are available everywhere, whether on the street, at workplaces, or in any other public spaces. it is a great way to getting a refreshing cold

drink, when you needed, especially on a hot summer day. This is a key factor that helps improve sales, however, it also has a negative impact on the environment due to the amount of energy consumed to maintain the business.

CO2 pollution has a huge impact not only on ecosystems but also on economies. The contribution of CO2 emissions from beverage production processes affects climate change, leading to rising global temperatures and unpredictable weather patterns. It is a threat to biodiversity and the balance of ecosystems. There will be more natural disasters happening more frequently, reducing agricultural production, and affecting many industries, not only the beverage industry. According to Kumar "Climate change increases the frequency and intensity of some disasters such as droughts, floods and storms. This has an adverse impact on livelihoods and food security. Climate-related disasters have the potential to destroy crops, critical infrastructure, and key community assets, therefore deteriorating livelihoods and exacerbating poverty", "Changes in climatic conditions have already affected the production of some staple crops, and future climate change threatens to exacerbate this. Higher temperatures will have an impact on yields while changes in rainfall could affect both crop quality and quantity. Climate change could increase the prices of major crops in some regions. For the most vulnerable people, lower agricultural output means lower incomes" (Kumar 124) which will lead to more complicated social problems. To understand more about the carbon footprint in the soft drink industry, there are two case study of Coca-Cola and Pepsi, two big company in the

beverage industry, how would they act to the carbon footprint problems.

Coca-Cola has made substantial commitments to minimize its carbon footprint. They stated on their website that "Coca Cola has progressed on its three focus areas on sustainability – waste, water and women economic empowerment.", they promised that "In 2018, The Coca Cola Company pledged robust World Without Waste global goals to help collect and recycle

the equivalent of a bottle or can for every one it sells by 2030, make 100% of its packaging recyclable by 2025, and use at least 50% recycled material in the company's packaging by 2030." (Coca-Cola). Also using more sustainable packaging materials that less virgin plastics for sachets and plastic straws In the Philippines. This case study explores Coca-Cola's strategy, that they lean forward to more enduring future by taking

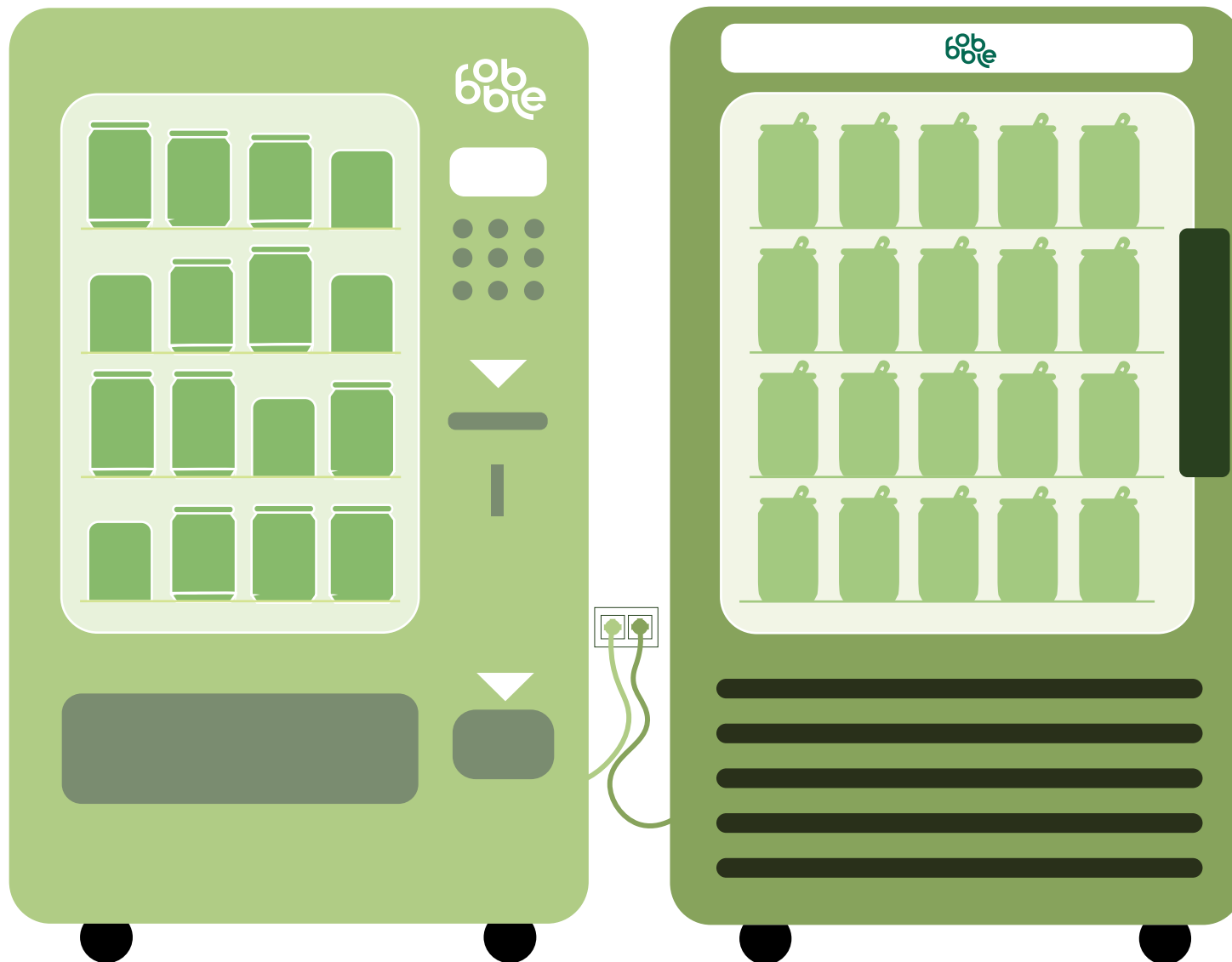
actions taken to reduce carbon dioxide emissions, their effectiveness, that will bring their product closer to everyone without worrying about damaging your living environment.

Similar to Coca-Cola, Pepsi public its GHG concern on its page, writing that "We not only have an interest in reducing greenhouse gas (GHG) emissions for the benefit of society—it's also crucial to the viability of our business, as we are already experiencing

the impacts of climate change directly within our value chain." (PepsiCo), also gives a picture for the future through their strategy "Our strategy focuses on the areas in which we have the greatest impact — manufacturing, agriculture, packaging, transportation and vending and cooling equipment. It requires that we use scalable solutions that are available today, but also acknowledges that achieving net-zero emissions by 2040 will likely require

new technologies and mechanisms. To this end, we continue to invest in promising solutions." (PepsiCo). Not only promising, but they also made some progress from last year, "In 2022, we issued a new \$1.25 billion Green Bond that will help to accelerate our pep+ ambitions" (PepsiCo), "We launched pep+ REnew to increase value chain partner access to renewable energy." (PepsiCo) and lastly, they use electric trucks in delivery by using Tesla Semis. This case study shows PepsiCo's sustainability journey, and its effort to make a better environment.

In conclusion, in order to reduce the carbon footprint in the soft drink industry, to reduce the environmental impacts. The manufacturing process needs to be changed from the ingredient choices and packaging materials also optimizing energy use, replacing traditional transportation with more eco-friendly vehicles, and more energy-efficient refrigeration. To prepare for a greener tomorrow, the industry must accept sustainable practices at each stage. These changes cannot happen one day, it is a long process. That requires the unity of many industries that are involved in the soda production process. Therefore, if they can achieve all these changes, they will successfully get closer to their goal that creating a more sustainable and environmentally friendly future. To make these changes, the soft drink industry can significantly reduce its environmental impact, getting closer to a more sustainable and environmentally future.



DESIGN RESEARCH



Questions:

How much CO₂ does a soft drink industry release every year?

What processes produce the most carbon footprint?

What are the packaging options?

Which soda company produces the most CO₂?

Assumptions:

Corn syrup making processes produce the most emission.

Glass bottles have the highest carbon footprint compared to other materials.

Soft drink industry contributes a huge amount of emissions into the air.



PLANNING

The planing is to find out the amount of co2 released to the atmosphere from the sugarcane processed, soft drink factory produced, shipping product process, and preserve drink.

Methods to conduct the research is visititng the store to see what soft drink options are in the market and what their message is. By taking soda section picture in some stores like Sam's club, Whole Food to see the packaging options.

I will do an online research method to investigate and gather data on the consumption patterns of carbonated drinks, including studying existing data, surveys, and relevant literature to understand consumer preferences and market trends.

As resources, the research need time and money, to learn about the subject and make the product.

This design research helps people aware of the amount of co2 released everyday to the environment, through 1 can/bottle of drink that they consume.



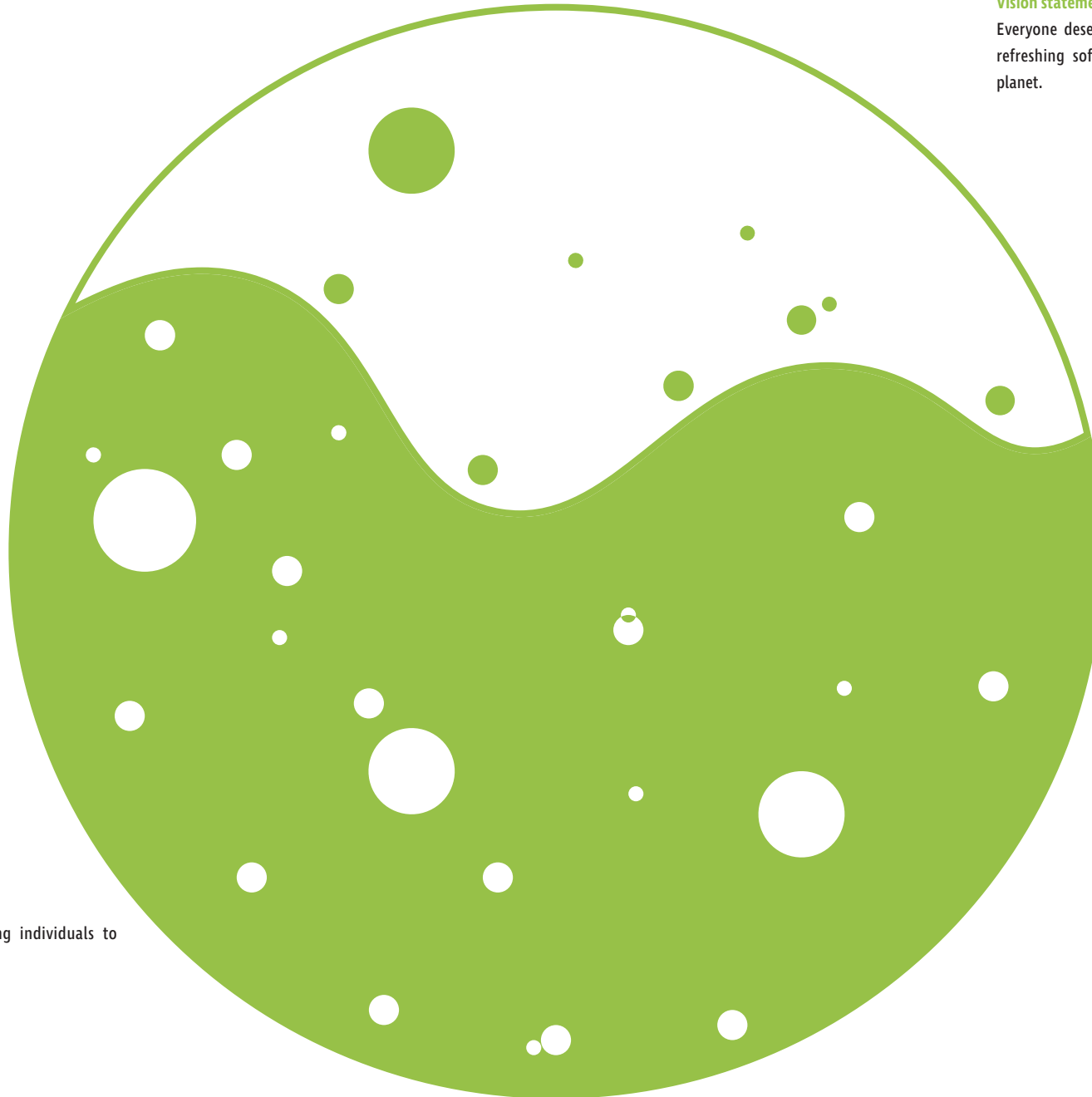
VALUE

Vision statement:

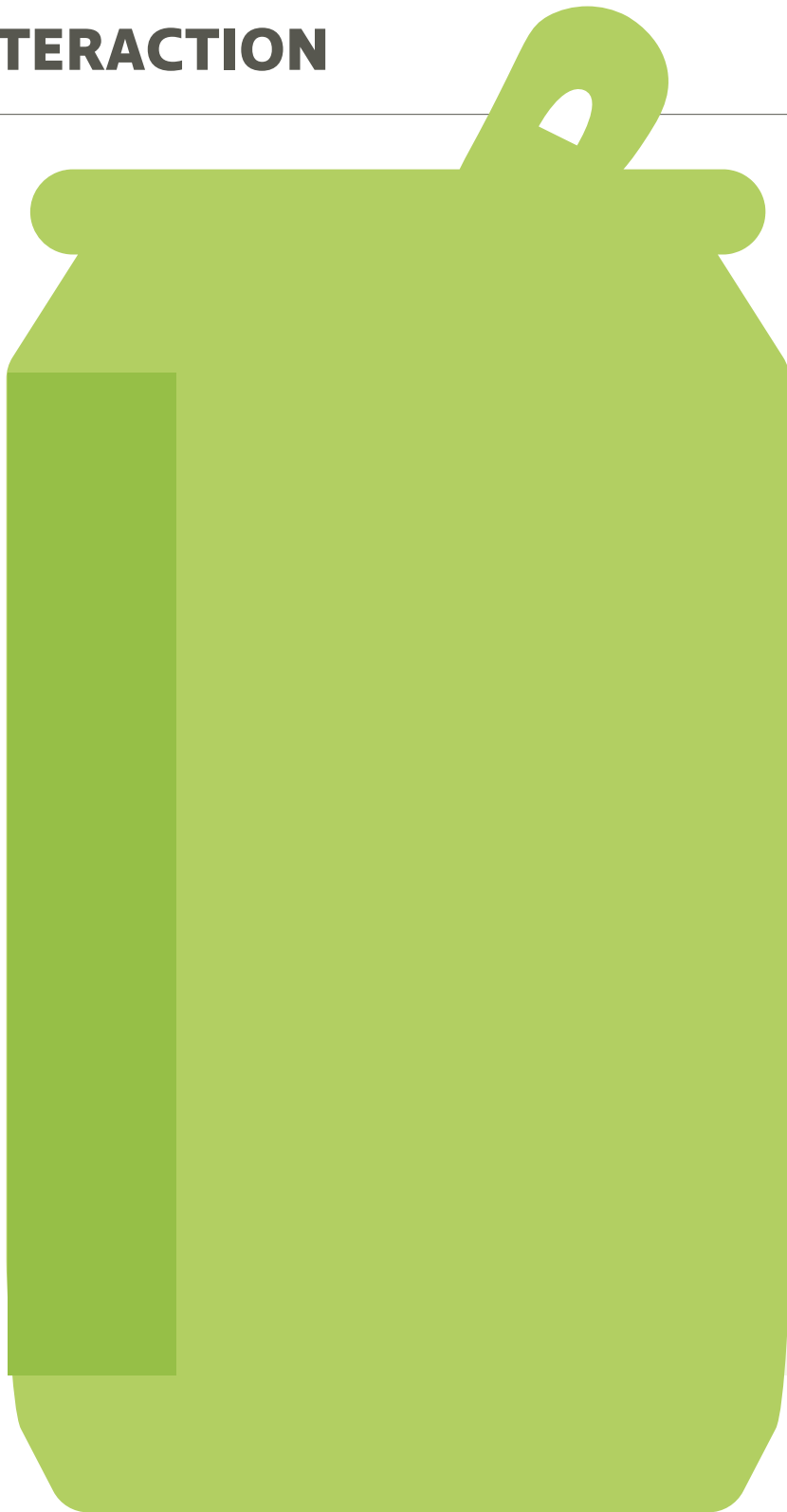
Everyone deserves to enjoy a delicious and refreshing soft drink without harming the planet.

Mission statement:

Encouraging and educating individuals to minimize carbon footprint.



INTERACTION



TARGETING

Goal:

To create a soft drink product line that provide a good quality and same experience, but decrease the carbon footprint in the production process. Communicating the environmental impact through product choices.

Interaction:

By selling the product in all the platforms. Choosing a specific color for the product design. The soda will be contain in a different material form, carton box.

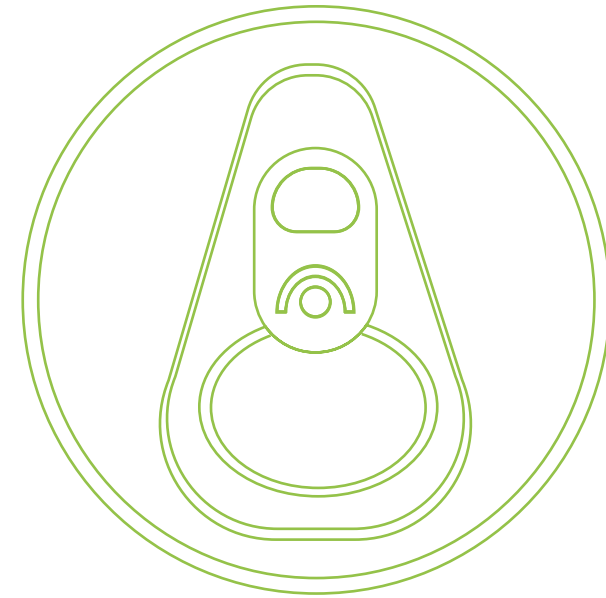
Objective:

Packaging design (carton box, can), website, poster to introduce the product to buyers, logo, advertisement (video) , photography, cup , business cards, toe bag.





PARTICIPATION



Our product does not discriminate against buyers; we focus more on the people, who are already on soda shelves. who care about environmental sustainability and are interested in supporting products with a low carbon footprint. The buyer participates by choosing our soda product. They could also help promote our product to other people, by sharing, and recommending our product online or in person so our product could reach the right audience. Participating show their environmental support by choosing our soda product, through us, they could contribute to the reduction of carbon emissions and a reduce the impact on the environment.

Participation is voluntary. Buyers have the freedom to choose our soda products based on their values and commitment to reducing their carbon footprint. We want them to be motivated and inspired by the benefits that our production makes to the environment. Through visuals, we want to convey the idea of protecting the environment, by choosing our product, they are participating in a more sustainable future.

AUDIENCE

PERSONA

Susan Huynh

Age: 45 years old.
Location: Troy, New York.
Job title: Teacher.

Have a family with 2 children, 10 years old, and 15 years old. Her kids are soda lovers.

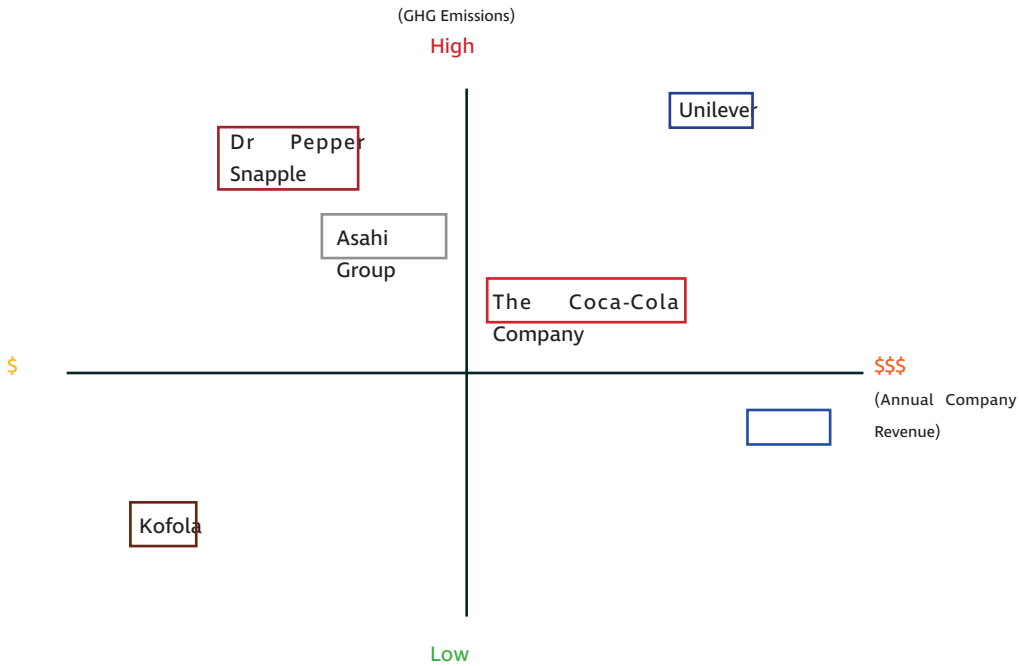
Quote:
" This product has lower carbon dioxide than other soda, but still has the pleasure taste and refreshing."




Goals:
Changing her children drinking choices by choosing different soda brand.

Persona attitude:
Susan is the mother of two kids, who cares about the environment. She comes to the store every week to get sodas for her kid. Susan wants to know her options in the same category, and how much benefit or impact she could make by purchasing soda. That is why Susan chose our product, not only contributing to saving the planet but also checking that the carbon footprint is reduced on our website, thanks to our eco-friendly production.



BRAND POSITIONING



	Sam's Cola Soda Pop, 12 fl oz, 12 Pack Cans 49.6¢/pt	\$4.46	Remove	Save for later	<div>- 1 +</div>
	Great Value Mountain Lightning Citrus Flavored Soda Pop, 12 fl oz, 12 Pack Cans 49.6¢/pt	\$4.46	Remove	Save for later	<div>- 1 +</div>
	Great Value Root Beer Soda Pop, 12 fl oz, 12 Pack Cans 49.6¢/pt	\$4.46	Remove	Save for later	<div>- 1 +</div>



PROJECT NAME:

EcoFizzGreenBubblySparkSipFizzyCrystalQuench

GreenQuenchBobblePureSipSodaFizzBubblyBliss

GreenSipSparqPopSipBubbleFlavorLoom

TYPE STUDY

Ingra Cd

Book

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo

Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

Bold

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo

Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

Ingra

Book

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo

Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

Bold

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo

Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

Sacramento

Regular

Aa Bb Cc Dd Ee Ff Gg Hh Ii Jj Kk Ll Mm Nn Oo

Pp Qq Rr Ss Tt Uu Vv Ww Xx Yy Zz

COLOR STUDY



HEX	182216	HEX	98c144	HEX	f5f6c9
RGB	24 34 22	RGB	152 193 68	RGB	245 246 201
CMYK	29.4 0 35.3 86.3	CMYK	21.8 0 64.8 24.3	CMYK	0 0 18.7 3.5



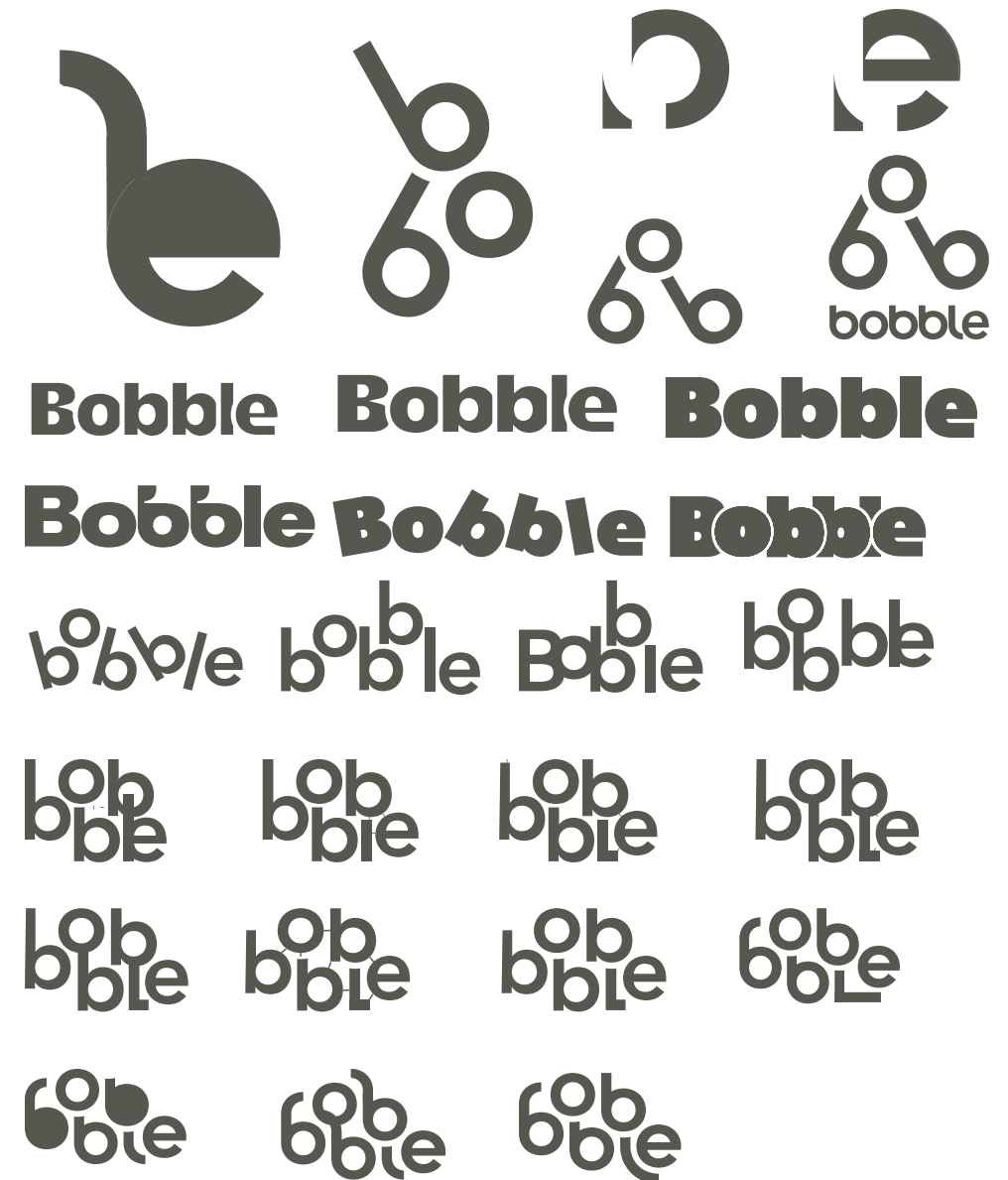
HEX	7764aa	HEX	beaed5	HEX	de1273
RGB	119 100 170	RGB	190 174 213	RGB	222 18 115
CMYK	30.7 41.2 0 33.3	CMYK	10.5 18.8 0 16.5	CMYK	0 91.9 48.2 13.3



HEX	e85586	HEX	ed8e22	HEX	eebd1c
RGB	232 85 134	RGB	237 142 34	RGB	238 189 28
CMYK	0 63.4 42.2 9	CMYK	0 40.2 85.7 7.1	CMYK	0 20.6 88.2 6.7

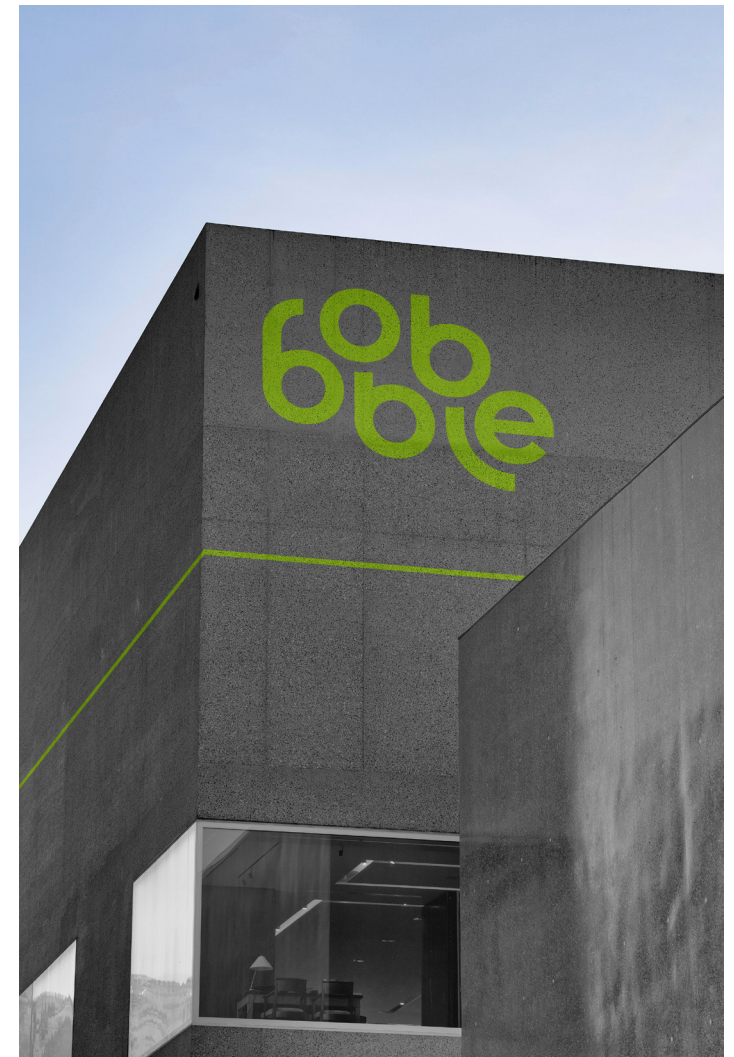
LOGO

Sketches Logo Study



OBJECT

Business Card
Envelop
Letterhead
Factory Mockup



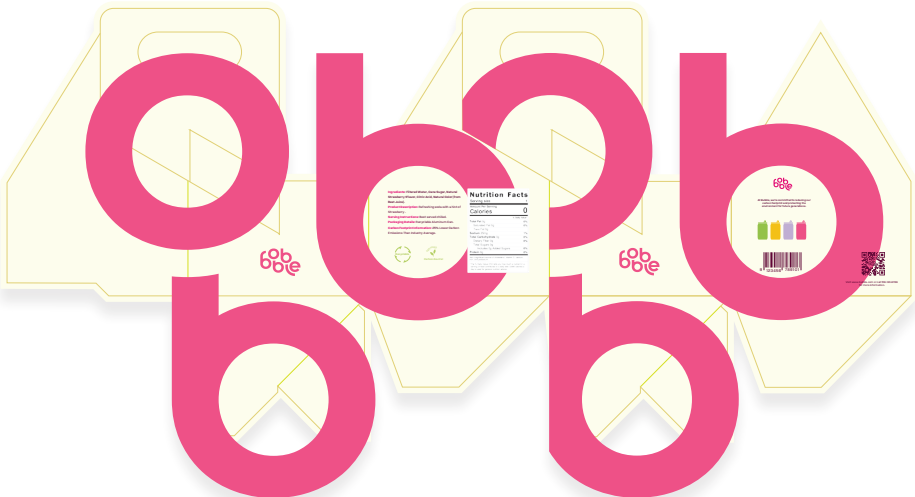
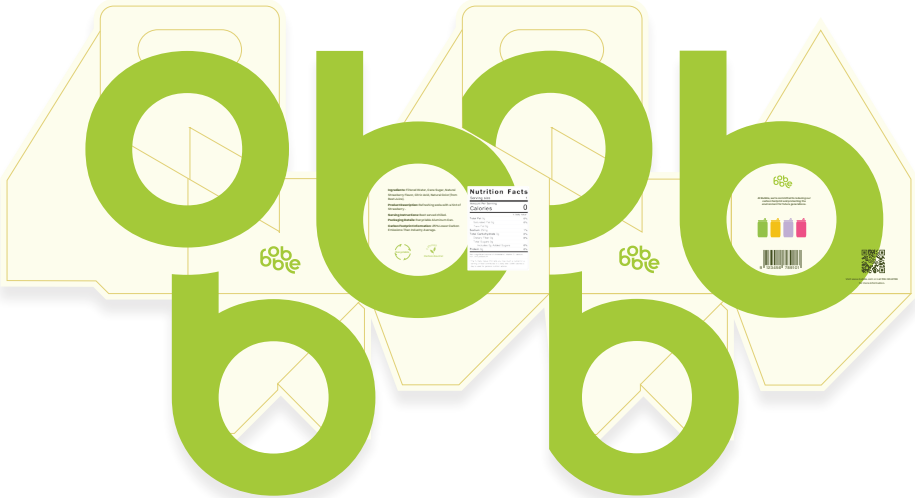
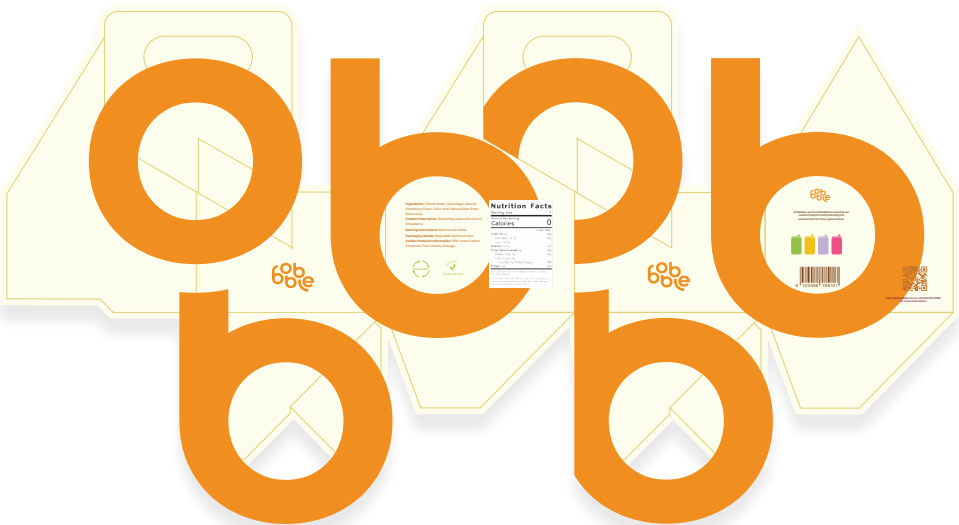
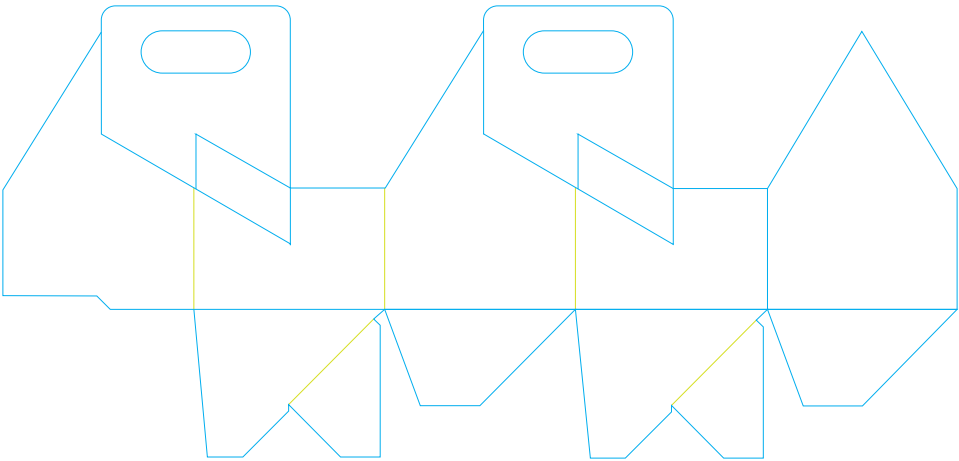
PACKAGING

Sketches Lables Design Process



PACKAGING

Can Holder Dieline

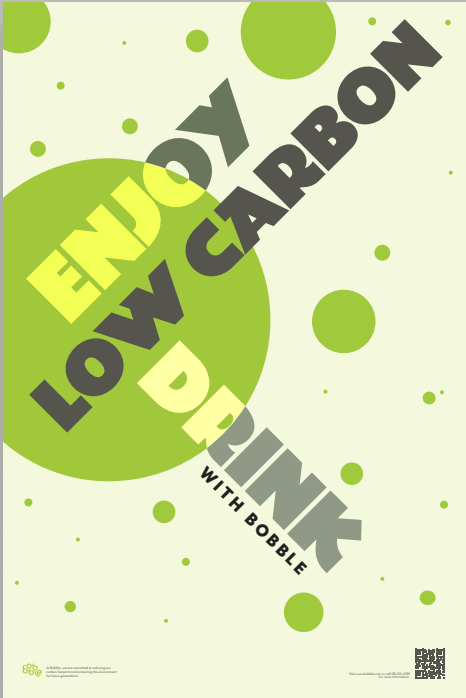


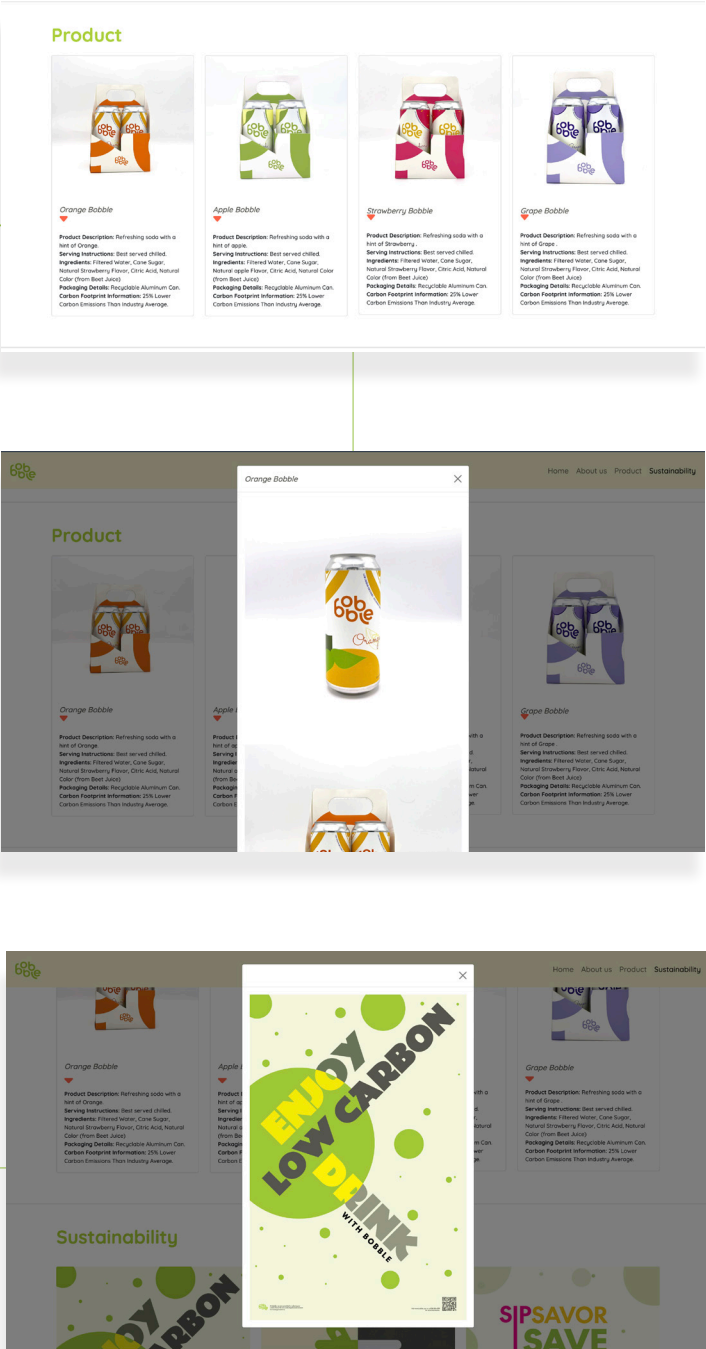
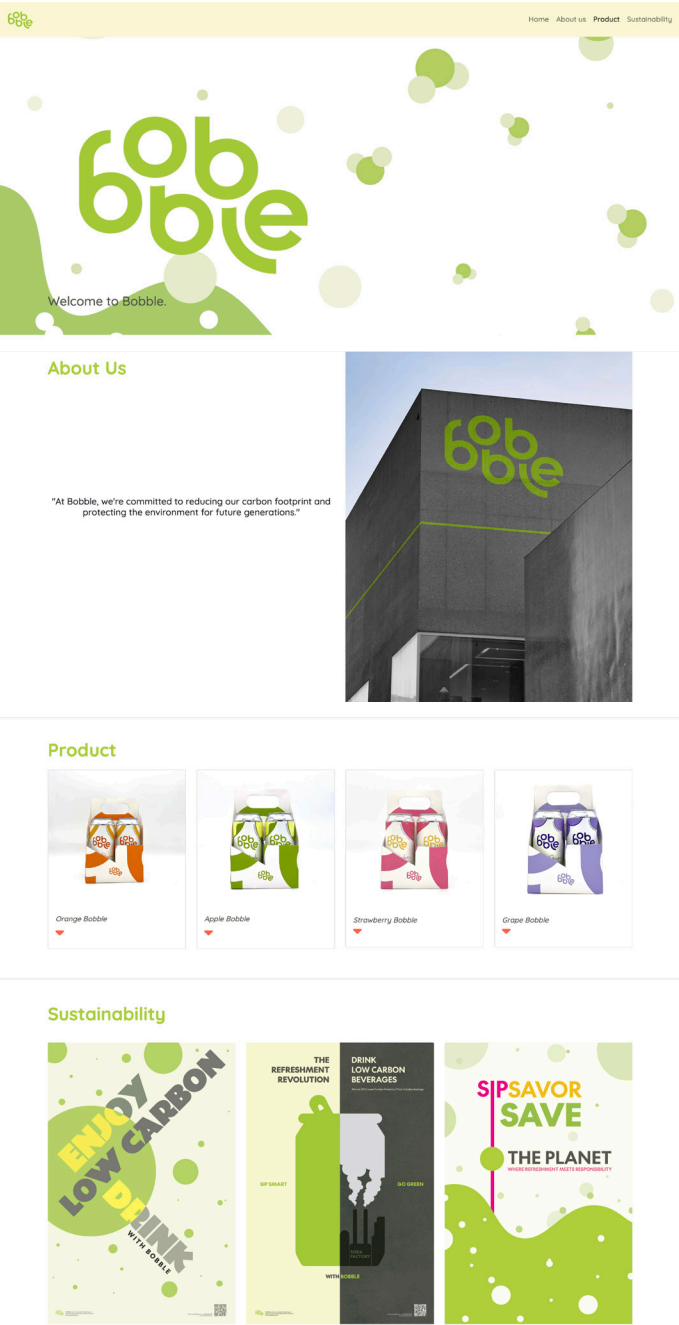
OBJECT

Can Holder Packaging
Can lables



POSTER





OBJECT

Stickers

