Carbon Capture Conspiracy

ENP161: Human Factors Product Design

December 20th, 2023

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Prepared for Prof. Intriligator

Agenda

Meet the Team

Ava Iannuccillo
(She/Her/Hers)

Arcadia Ohnemus
(She/Her/Hers)

Michael Yung
(He/Him/His)

Ege Cogulu
(He/Him/His)

Introduction

Semester Project

PROBLEM

Carbon capture and storage (C.C.S.) is advocated as a green energy solution, with the US government is investing billions of dollars for its proliferation. The climate crisis is a critical contemporary issue and valuable resources are being used to develop technology that doesn’t effectively reduce carbon emissions.

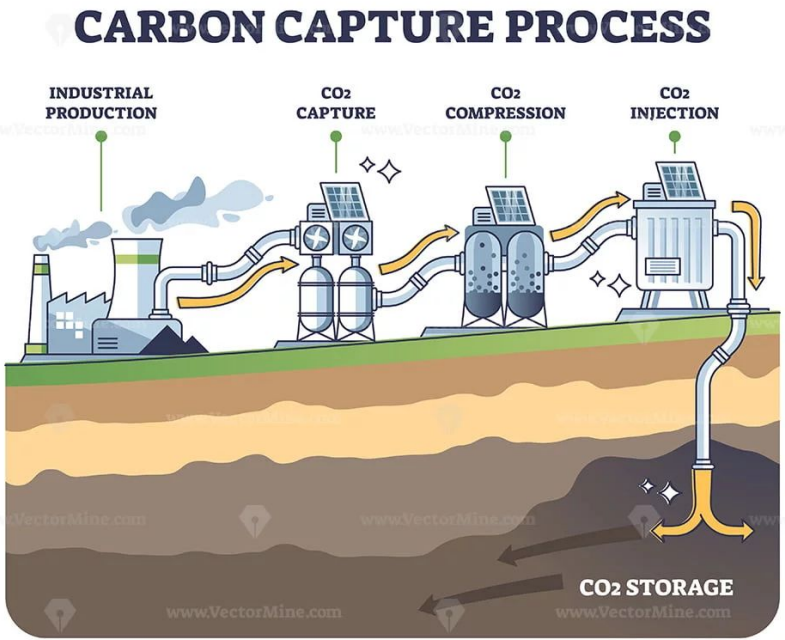
CHALLENGE

Design and develop an intuitive website that clarifies the environmental implications of carbon capture and storage (C.C.S.), and advocates for redirecting resources from C.C.S. toward renewable energy solutions.

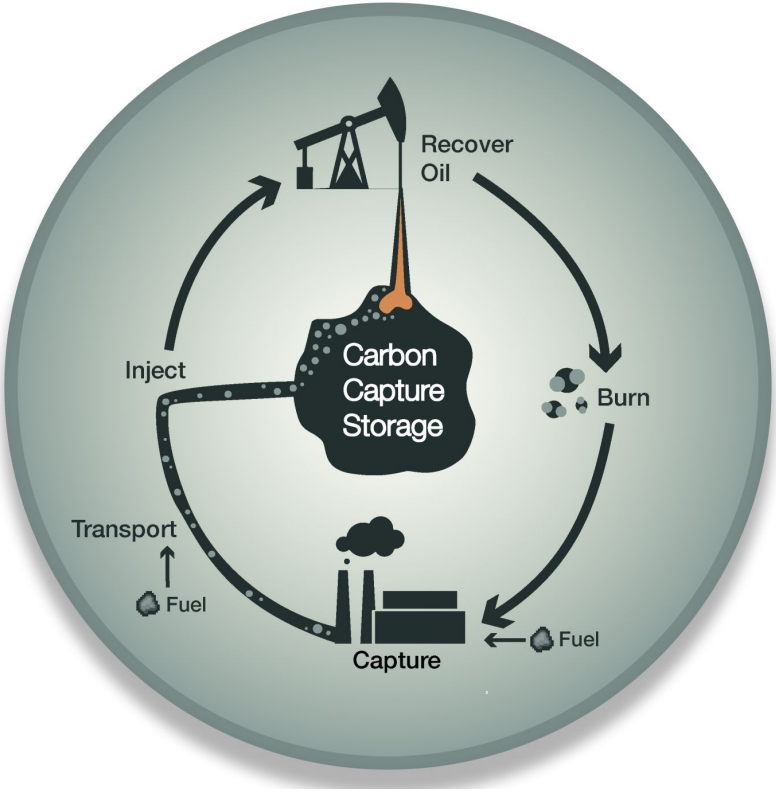
What is Carbon Capture and Storage?

C.C.S refers to a set of processes and techniques designed to **capture CO2 emissions from industrial processes** before their release into the atmosphere. Key processes include:

1. Collecting carbon dioxide (CO2) from industrial plants
2. Transporting it to a C.C.S. facility
3. Injecting it underground to be stored



What's Wrong With It?



1. Most captured carbon is used for enhanced oil recovery (EOR). EOR is the process of injecting carbon dioxide into oil reserves, displacing oil to recover more than what is normally possible.
2. Manufacturing and running C.C.S .facilities require significant energy, increasing CO2 emissions.
3. The government funds C.C.S. on the basis of carbon captured, not avoided.
4. C.C.S. redirects government funds that should be used for viable renewable energy solutions.

Customer Life & Research

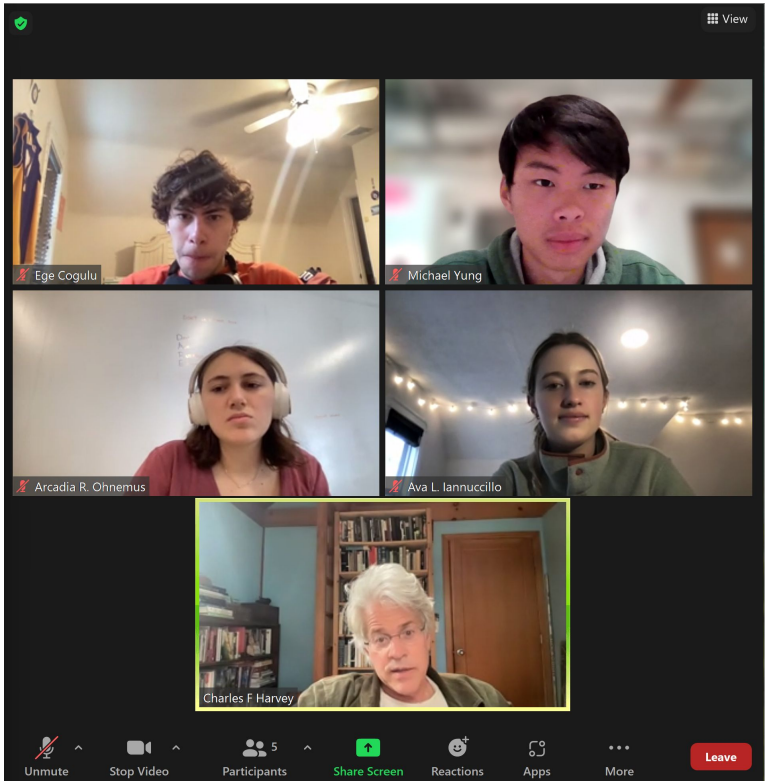
Interview with Professor Harvey

Understanding our Audience:

- Policymakers
- Media sources
- Scientists

Impacts on Design

- High reputability
- Accessible facts
- Cater to all levels of knowledge
- Action/advocacy



Interview with Professor Harvey

Key Arguments:

1. Investments into C.C.S. Will Sustain the Fossil Fuel Infrastructure
2. C.C.S. is Used to Obtain More Fossil Fuels
3. Inflation Reduction Act Subsidizes C.C.S. with Section 45Q of the Federal Tax Code

User Needs & Requirements

Primary Research

1. **A homepage focused on critical user tasks:** Users reported that they get confused when the main task they hope to complete on a website is hidden. The users should not have to search to find the main features of the website interface.
2. **Effective Navigation:** Users enjoy when they can easily go back to the page they were on before and move to a new part of the website quickly. Users should always know where they are on the website interface and how to get to any other page.
3. **Incorporated stories to enhance user engagement:** Users report that when there are engaging visuals, they have a more pleasant experience and stay on the website longer.
4. **Well-formatted Content That Is Easy to Scan:** Users report skimming over large blocks of text on websites. The content should be formatted to reduce large blocks of text and so that key information can still be understood even when scanning the website.
5. **Users need the information to be accurate and informative:** Users report that they need the information they read on websites to be truthful, so they can cite it in their work. The content must be from trustworthy sources and should make the sources clear so that users can easily reference them.

1. The home page of the website interface must have the 3 main features of the website as the first elements seen when the page opens, including the main CCS fallacies, the most recent blog post, and a downloadable letter to send to a senator.
2. The website interface must have a navigation bar containing all the key features, including Home, About, Blog & News, CCS fallacies, CCS alternatives, and resources.
3. The website content must have at least one visual for every paragraph of information.
4. Content must be organized with clear headings, subheadings, bullet points, and concise paragraphs. Each page must maintain a balance between text and visuals, with a maximum of 250 words in any single section. Important information, such as product specifications or key findings, should be highlighted through text formatting or visual cues.
5. All content must be meticulously fact-checked and supported by citations from reliable sources. These sources must be cited within the text or through hyperlinked references, and a dedicated "References" or "Sources" section must be provided.

User Needs & Requirements

Desk-Based Research

1. **Accessibility:** The website interface must adhere to World Wide Web Consortium (W3C) guidelines for developing a perceivable, operable, understandable, and robust interface for users with accessibility needs. Users need interfaces that contain legible fonts, adjustable text sizes, high contrast, and alt text for images (WAI, 2005).
2. **Fast Load Times:** When originally loading and interacting with components on the website interface, users expect it to load quickly on their devices. Research has shown that increasing loading time from one to three seconds could result in a 32% increase in bounce rate, negatively affecting user engagement (Xilogianni, 2022).
3. **Responsive Design:** Users want the website interface to adapt to their various devices to maintain a consistent and user-friendly experience. Users demonstrated reduced total scrolls and clicks by 26% and 55% when exploring information architecture on responsive as compared to non-responsive web designs (Lestari et al., 2014).
4. **Recognizing, Diagnosing, and Recovering from Errors:** Users need clear error messages and corrective guidance in web interfaces, with plain language communication and visual cues to enhance noticeability. The Nielsen Norman Group Huersitic #9 highlights the need to reduce users' cognitive load in resolving errors immediately (Moran, 2019).
5. **Aesthetic and Minimalist Design:** Users need their website interface to incorporate key visual elements that are directly tied to their primary goals. Research indicates that users form an aesthetics-driven first impression of a site within 50 milliseconds, 10 times faster than reading (Fessenden, 2021).

1. The website interface must utilize an accessible font noted as a Sans-Serif or Serif. To accommodate individuals with low vision or color blindness, color contrast must be a 4:5:1 ratio for text and a 3:1 ratio for images. Furthermore, alt text must be provided for all images present on the interface (UNCG, 2019).

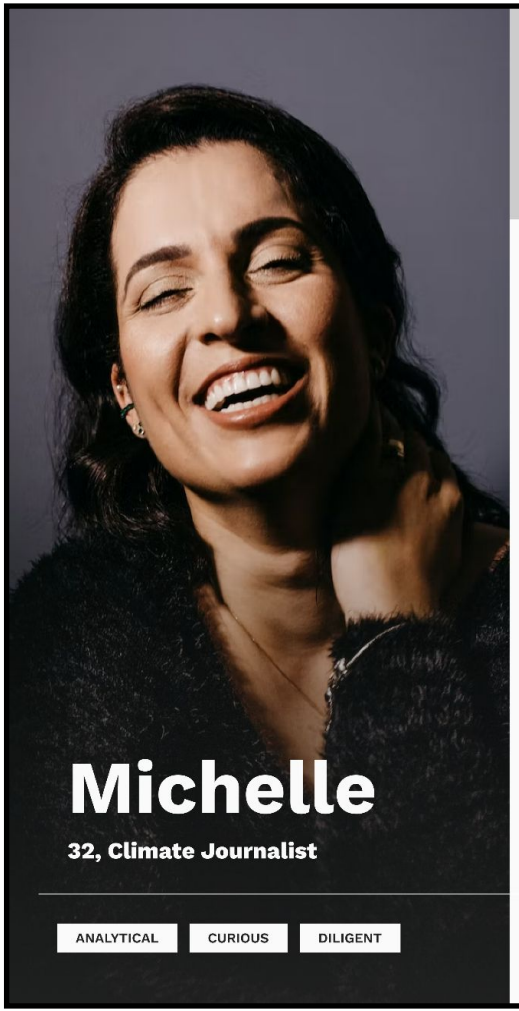
2. The website must have a load time that is no longer than 2 seconds. The website interface must optimize images, reduce HTTP requests, use browser caching, and employ CDNs for content delivery (Green, 2016).

3. The website UI must appropriately adapt and size the information architecture, fonts, images, and components of the website to resolution sizes ranging from 320 x 480 pixels on mobile devices to 1280 x 760 on desktops (Lestari et al., 2014).

4. The website adheres to WCAG 3.3.6 which requires an error prevention mechanism. The website must provide the user the ability to review, confirm, and correct information before finalizing their submission (WAI, 2005).

5. The website should utilize headings and subheadings (H1s, H2s, H3s, etc.) to visually organize text content. Website aesthetics must contain cleanly aligned visual elements with the use of white space and a consistent application of selected mood boards across all screens (Moran, 2017).

CLIMBER Personas



Michelle

32, Climate Journalist

ANALYTICAL | CURIOUS | DILIGENT

ABOUT

Michelle is a dedicated climate journalist at the New York Times. Her mission: inform public perception toward climate change and advocate for sustainable environmental policies.

AGE	32
OCCUPATION	Event Planner
INCOME	More than $120k
LOCATION	Buenos Aires, Argentina

FEARS

- False beliefs hinder renewable energy.
- CCS worsens climate change, fueling fossil use.
- Public misunderstandings stall environmental laws.

LOVES

- Empowering decisions with accurate information
- Revealing truth through comprehensive journalism.
- Advocating for precision in reporting

ASPIRATIONS

- Shift CCS narrative for a greener future.
- Foster discussions to dispel misconceptions.
- Influence public perception towards sustainability.

TRAITS

- Diligent and committed
- Curious and analytically inclined
- Passionate about reporting

ACTIVITIES

- Conducts interviews, research, and writes informative articles.
- Reads the news and stay informed often.
- Engages in consistent reporting.

RELATIONSHIPS

- Collaborates with environmental experts.
- Engages with policy makers.
- Connects with like-minded individuals.

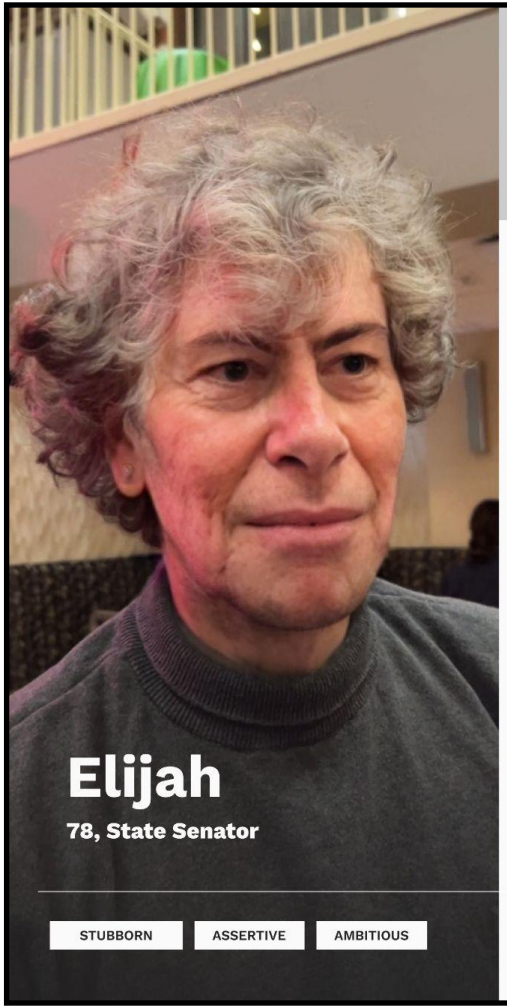
GOALS

- Correcting Misconceptions: Dispel public misunderstandings about CCS through journalism.
- Policy Influence: Drive awareness for sustainable policies and a transition to renewable energy.
- Green Advocacy: Promote a shift towards greener energy solutions.

CHALLENGES

- Countering misinformation and misconceptions about CCS.
- Communicating complex information amid mixed messages.
- Effectively sharing the complexities and implications of CCS.

CLIMBER Personas



Elijah

78, State Senator

STUBBORN | ASSERTIVE | AMBITIOUS

ABOUT

Elijah, a Pennsylvania State Senator, navigates the balance of lobbyist interests while actively collaborating with communities to champion climate sustainability policies. Amid external pressures, he strives to craft enduring policies that leave a positive legacy.

AGE	78
OCCUPATION	Senator
INCOME	More than $150k
LOCATION	Harrisburg, PA

FEARS

- Losing CSS lobbyists' support.
- Opposing popular bipartisan policies.
- Being viewed as a sellout.

LOVES

- Economic growth in Pennsylvania
- Holding powerful position
- Public adoration

ASPIRATIONS

- Climbing to higher positions of power.
- Leaving a legacy of public service.
- Being on the right side of history.

TRAITS

- Makes decisions often based on heuristics.
- Holds strong convictions.
- Hard to persuade.

ACTIVITIES

- Reads journals about the latest climate research.
- Works with a marketing team to promote political initiatives.
- Participates in climate rallies to engage with the public.

RELATIONSHIPS

- Regularly communicates with climate organizations
- Engages with investors to discuss state policies.
- Aligns policies with fellow Democrats.
- Informs journalists of current policies.

GOALS

- Improving the economy of Pennsylvania while minimizing the climate effect of that growth
- Making policy initiatives for climate sustainability.
- To garner public support over his policies on climate action.

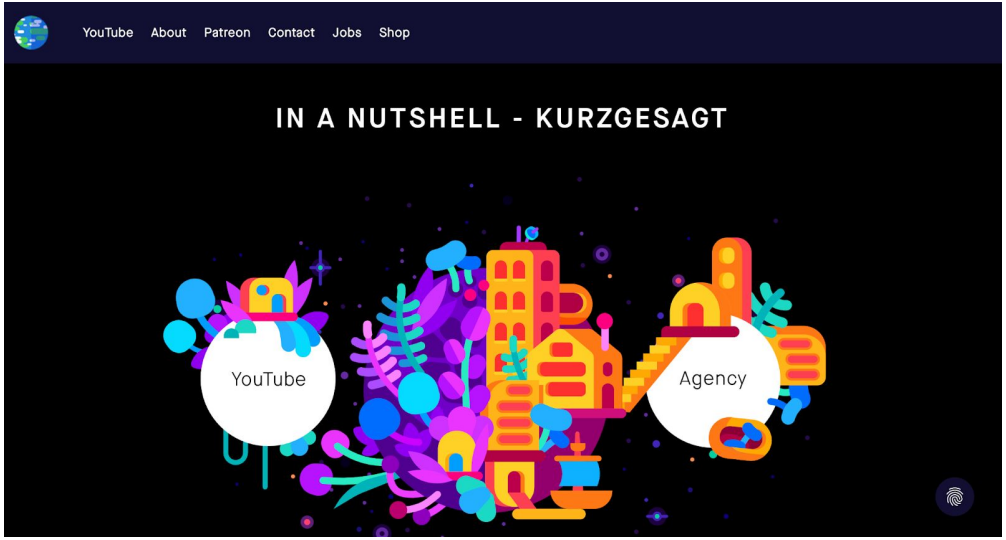
CHALLENGES

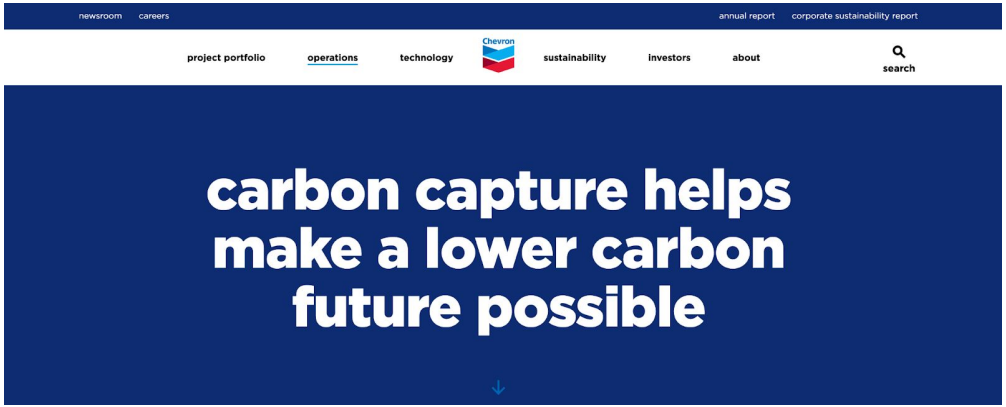
- Fears opposition from all sides by opposing CCS which is perceived as climate-friendly.
- The public lacks awareness and understanding of CCS to back him.

Web UI Research

Key Considerations

- Eye Catching
- Impactful
- Easy to Navigate
- Simple

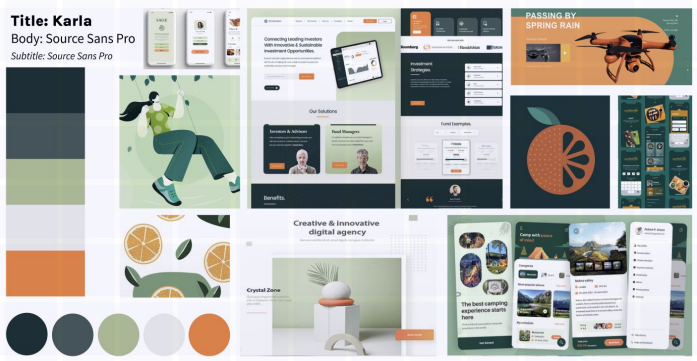




Ideation

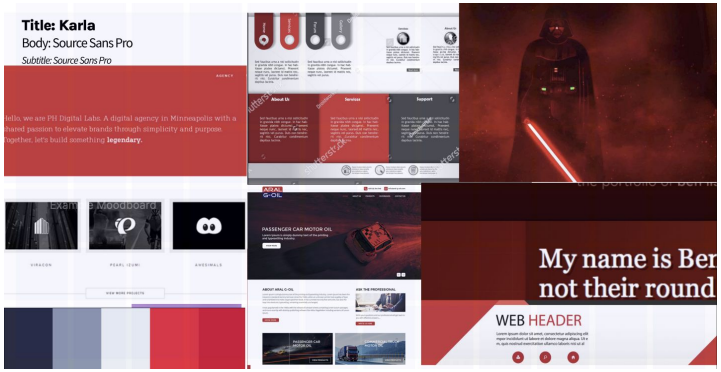
Moodboard Exploration

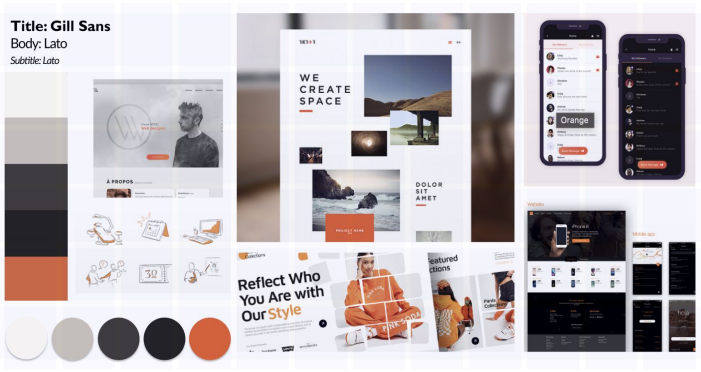
High energy and youthful



Calm and trustworthy

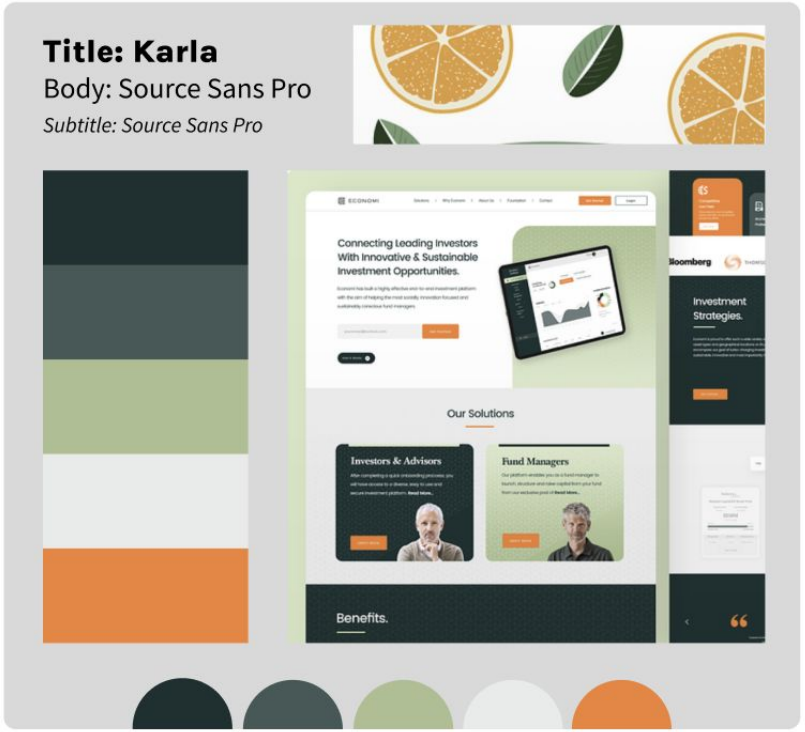
Exposing evils

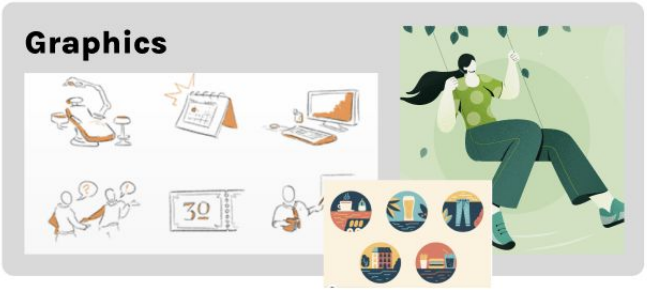


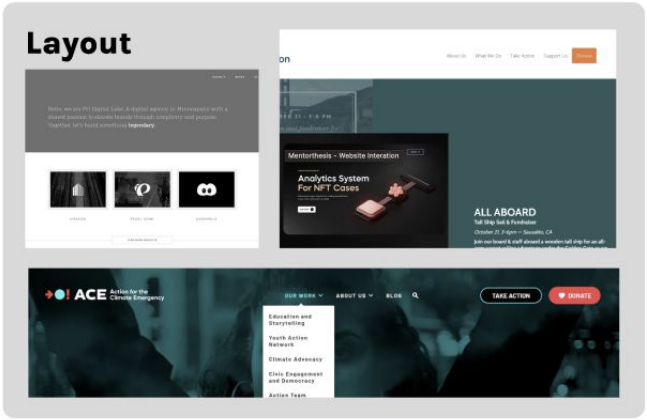


Neutral and digestible

Final Moodboard

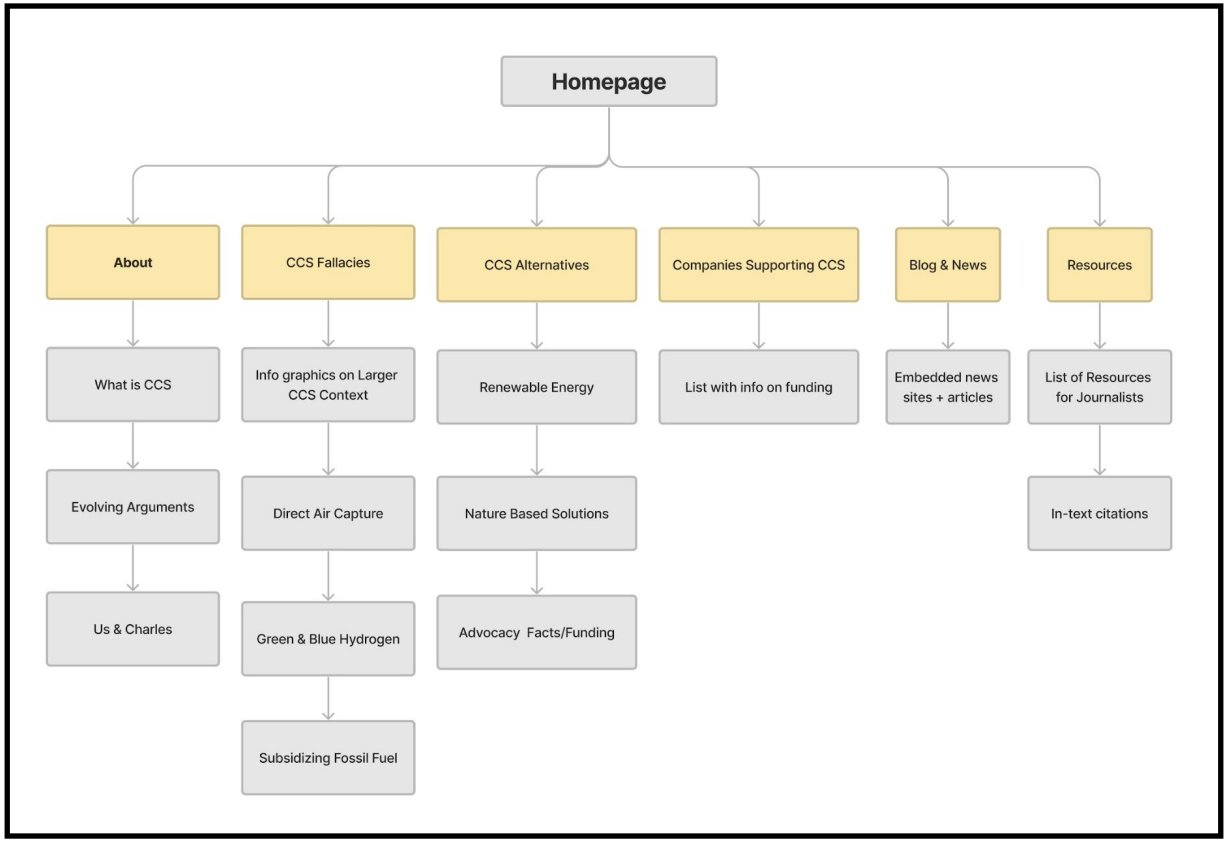




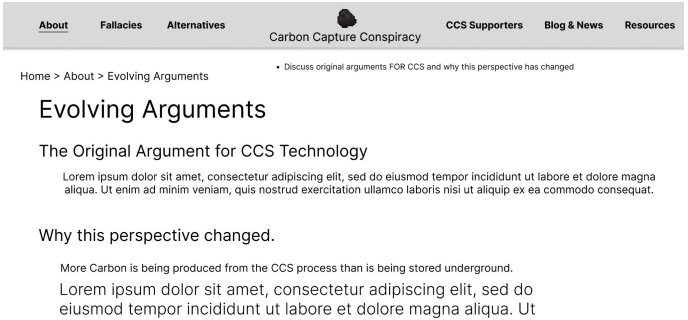


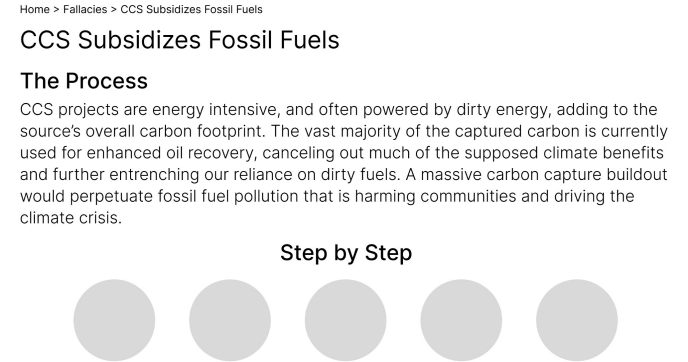
Calm and trustworthy for ethos!

Information Architecture



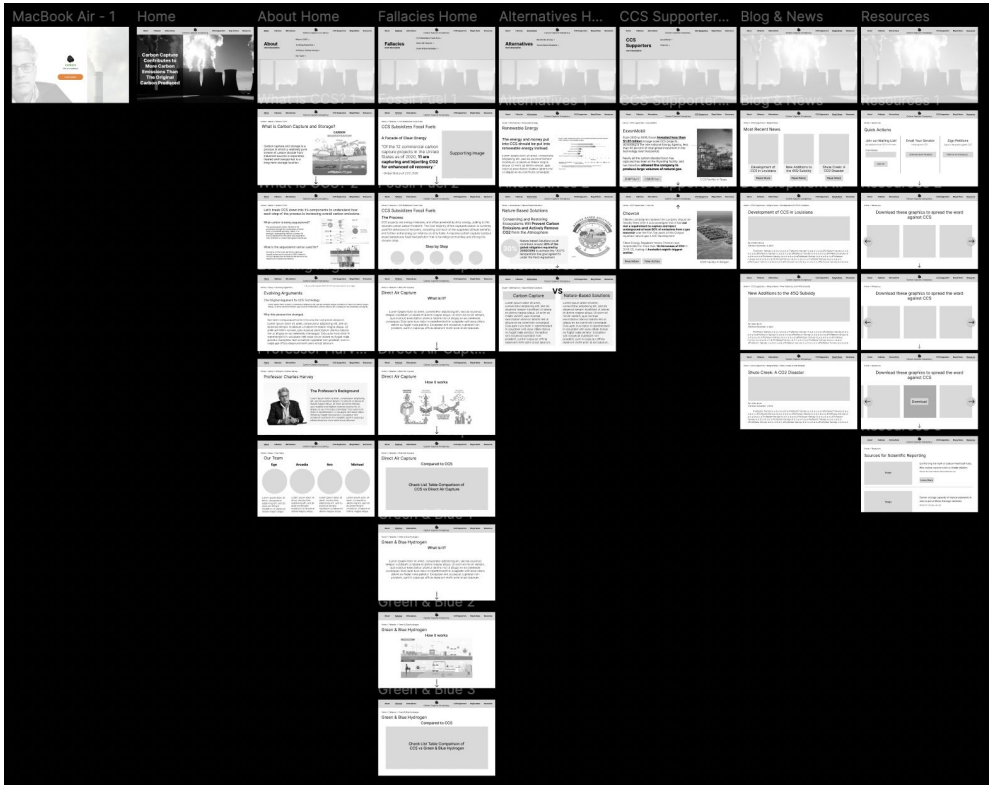
Wireframe Version 1: Detailed Information Focused





Wireframe Version 1: Detailed Information Focused

- Scientific
- High reputability



Wireframe Version 2: Infographic-oriented

Unmasking Carbon Capture | Home | About | Arguments | CCS Supporters | Blog & News | Resources

Capture capture is a vicious cycle of fossil fuel use

"4Q is is is 4Q is is is4Q is is is4Q is is is4Q is is is4Q is is is"

Carbon Capture and Storage (CCS) is a contentious technological approach aimed at managing carbon dioxide (CO2) emissions from industrial activities and power generation. It involves capturing CO2 emissions from sources like power plants or factories and storing them underground in geological formations such as depleted oil and gas reservoirs or deep saline aquifers. While touted as a solution to curb greenhouse gas emissions.

Unmasking Carbon Capture | Home | About | Arguments | CCS Supporters | Blog & News | Resources

Take Action With Us

Place holder text

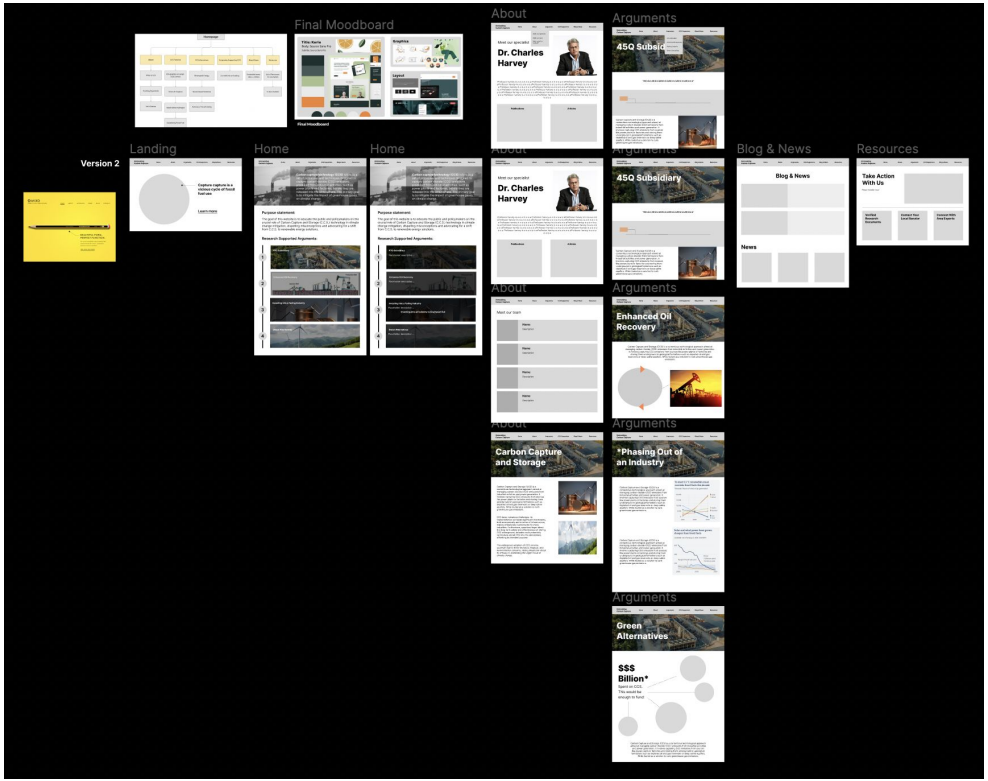
Verified Research Documents

Contact Your Local Senator

Connect With Area Experts

Wireframe Version 2: Infographic-oriented

- Focus on graphics
- Simple, clear information
- Only main arguments

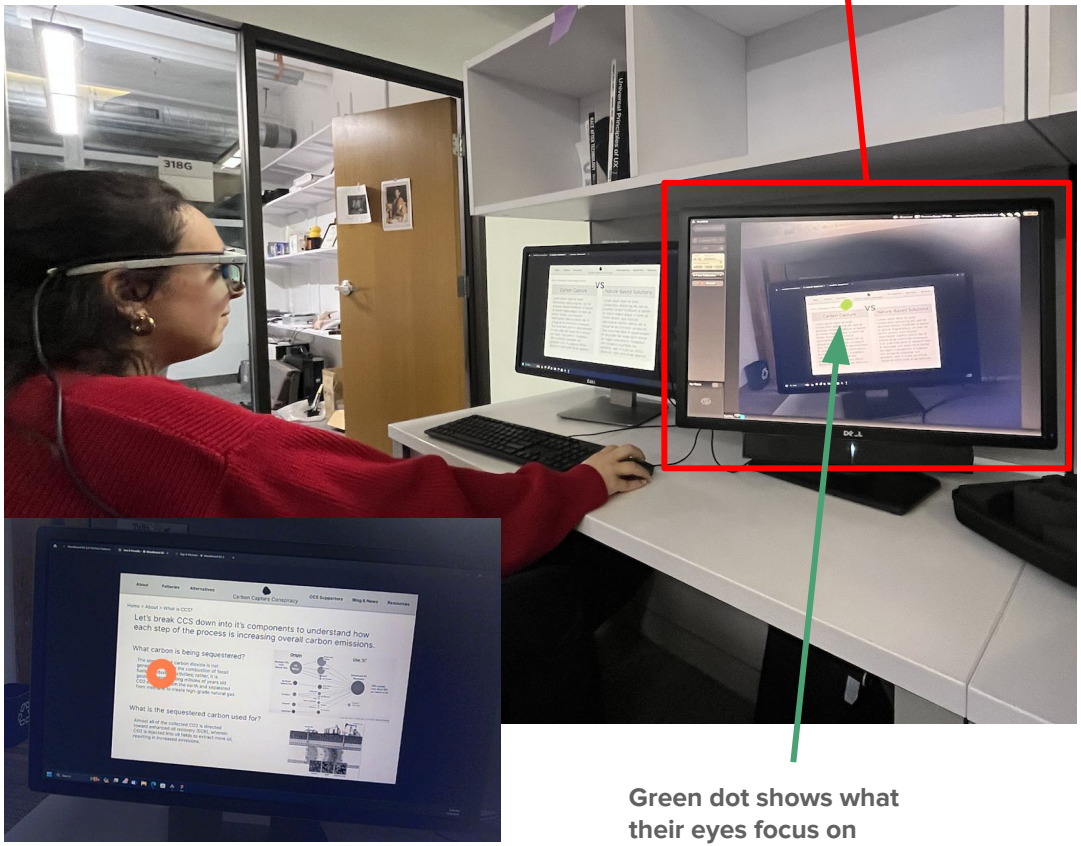


Evaluation

Usability & A/B Testing

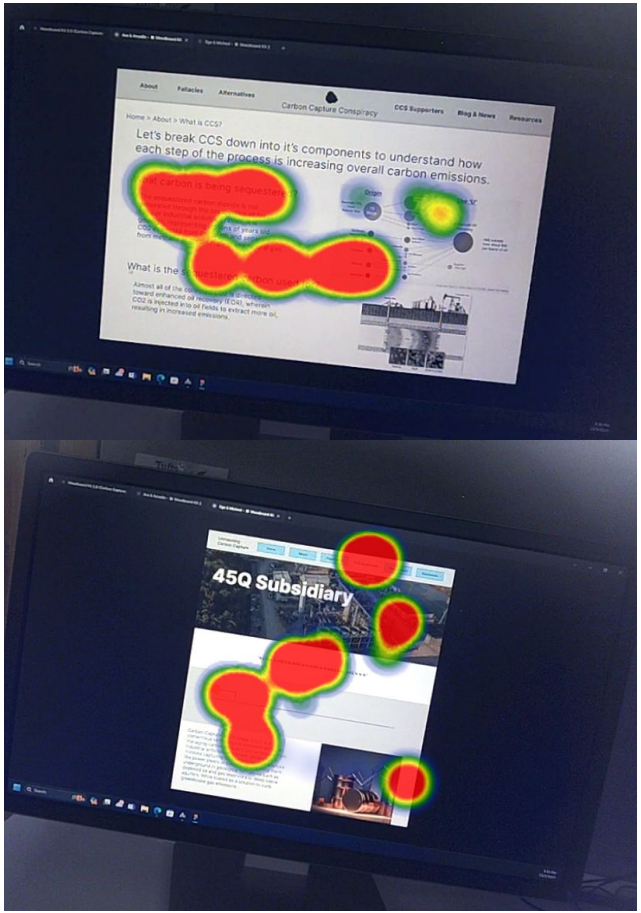
Usability & A/B Testing

- Interviewed 3 participants as they navigated our wireframe websites.
- Observed their perspective in real-time.
- Analyzed eye-tracking video afterwards.



Eye-Tracking Results

Heatmaps of the first five seconds a participant spent on a page



Big Picture Findings:

1. Emphasis on simplicity and making concepts digestible
    a. Diagrams, infographics and visuals beneficial at achieving this
2. Visual contrast and diversity increased user interest and attention
    a. More time was spent on a page and users would continue scrolling through it
3. Complex graphics and diagrams lost user attention + often ignored
4. Pages that were too long or text-heavy lost user attention (limited attention span)

Interview Results

Summary:

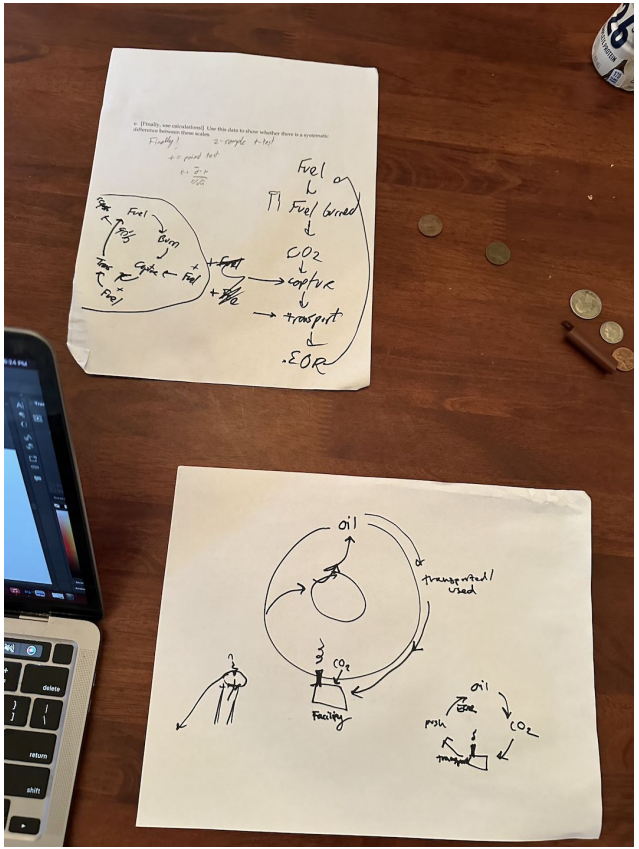
1. All participants preferred Version 2 over Version 1
2. Participants experienced difficulty understanding wordy titles
3. Participants found motion effects engaging
4. Include navigation button to the next page at the end of pages

Minor Fixes:

- Have dropdown menus pop up by hovering, not clicking
- Explain acronyms
- Logo should click home

Other Takeaways to Implement

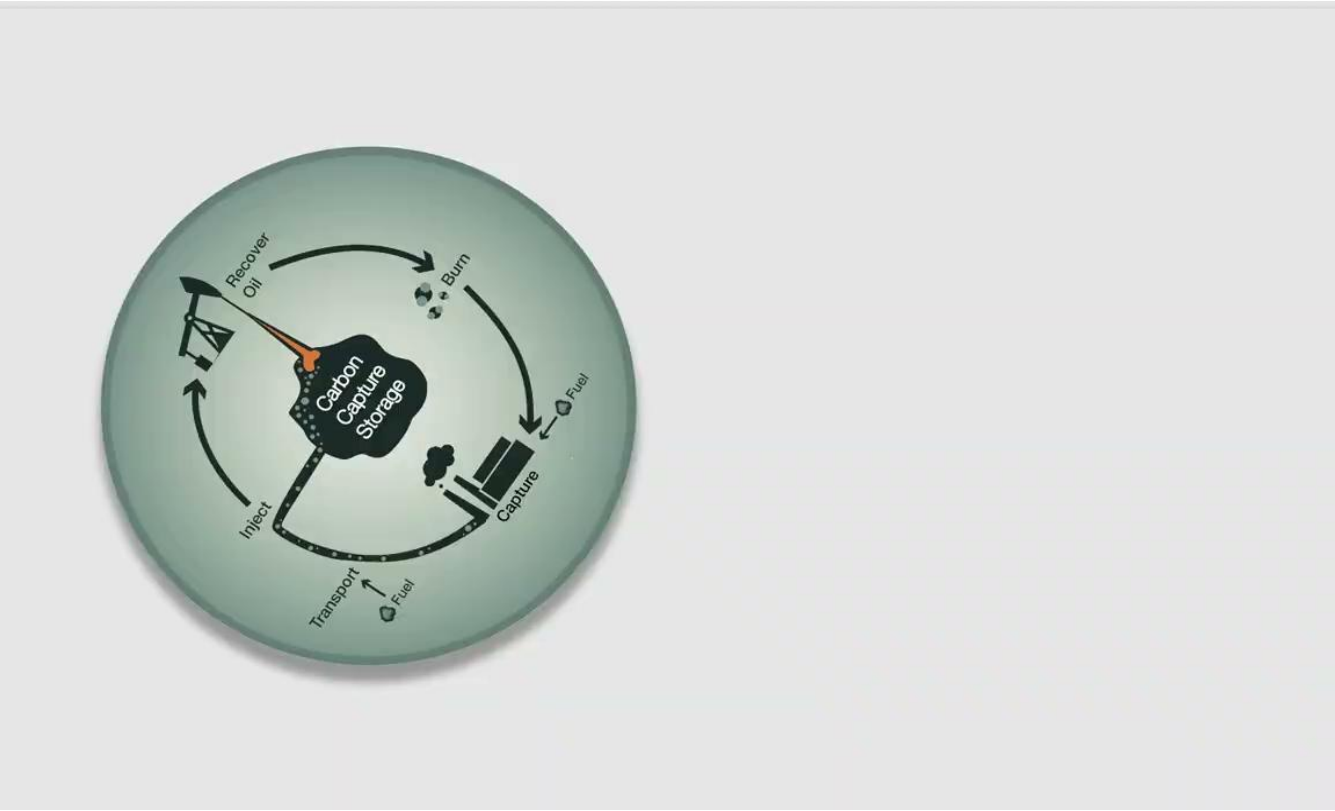
- Better highlight connection between CCS and perpetuation of fossil fuel industry
- Restructuring IA to streamline arguments and improve ease of navigation
- **Simplicity**! In both argument and formatting



Reimagining our web content based on user feedback

Final Product

Unmasking Carbon Capture & Storage



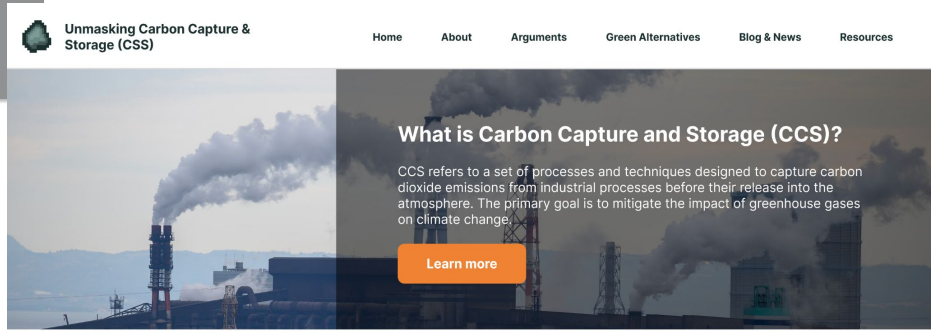
Unmasking Carbon Capture & Storage

$120
per metric ton
to capture CO2

which doesn't even include the total metric costs associated with the storage and transport of CO2.

Average transport and geologic sequestration costs for the top 80% of US stationary CO2 emitters: $2-$38/ton for transport and $7-$11/ton for storage.

[Figma Prototype]

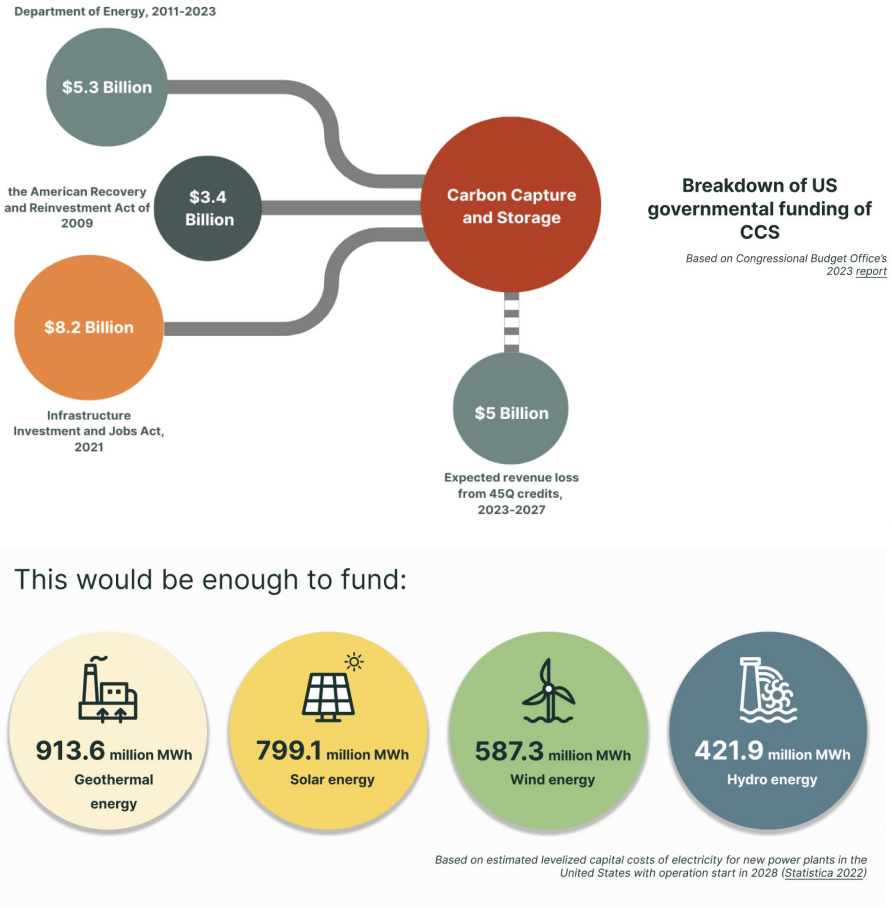


Purpose statement:

The goal of this website is to educate the public and policymakers on the crucial role of Carbon Capture and Storage (C.C.S.) technology in climate change mitigation, dispelling misconceptions and advocating for a shift from C.C.S. to renewable energy solutions.

Future Work

1. **Design Finalization**
   - Get feedback from Dr. Harvey and finalize arguments accordingly.
   - Run another user test to reiterate hi-fi design
2. **Publish Website**
   - Secure funding to translate hi-fi prototype into a website.
   - Advertise and promote website on Tufts channels.
   - Take down fossil fuel companies



Visuals we designed for our website

Thank you!