MICHIGAN STATE UNIVERSITY

Project Plan Presentation

Visualizing Nuclear in Michigan

The Capstone Experience

Team Anthropocene Institute

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From Students…
…to Professionals

Project Sponsor Overview

- Committed to promoting affordable and sustainable energy
- Investigating ways to lower energy production cost to improve environment outcomes
- Mainly focused on replacing coal power plants with nuclear plants



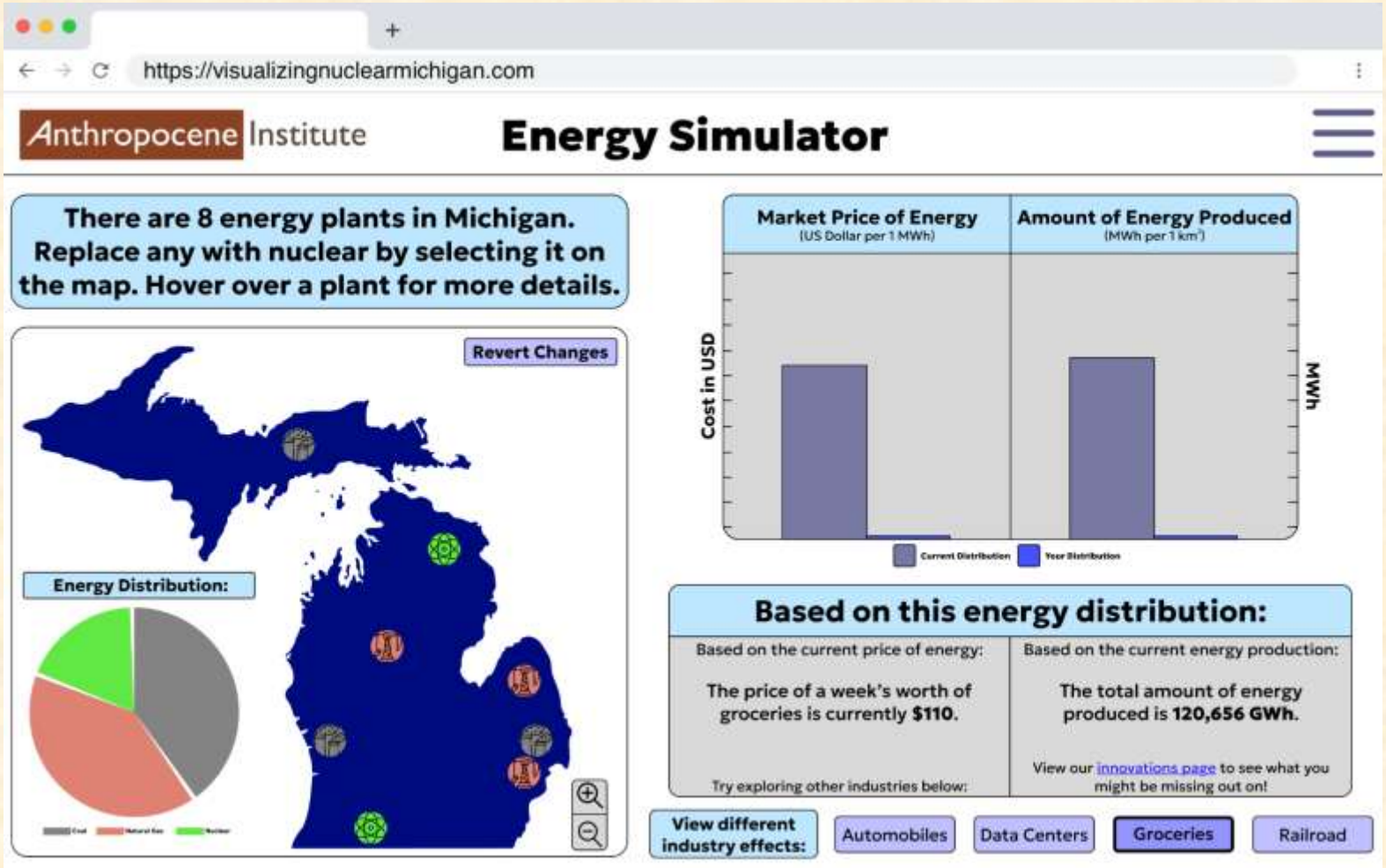
Project Functional Specifications

- Improve public understanding of nuclear energy as a clean energy source
- Interactive simulator to visualize economical impact of nuclear energy in Michigan
- Showcase the innovations possible with abundant, cheap energy
- Convey benefits of replacing fossil fuels with nuclear energy to investors, business leaders, and policymakers

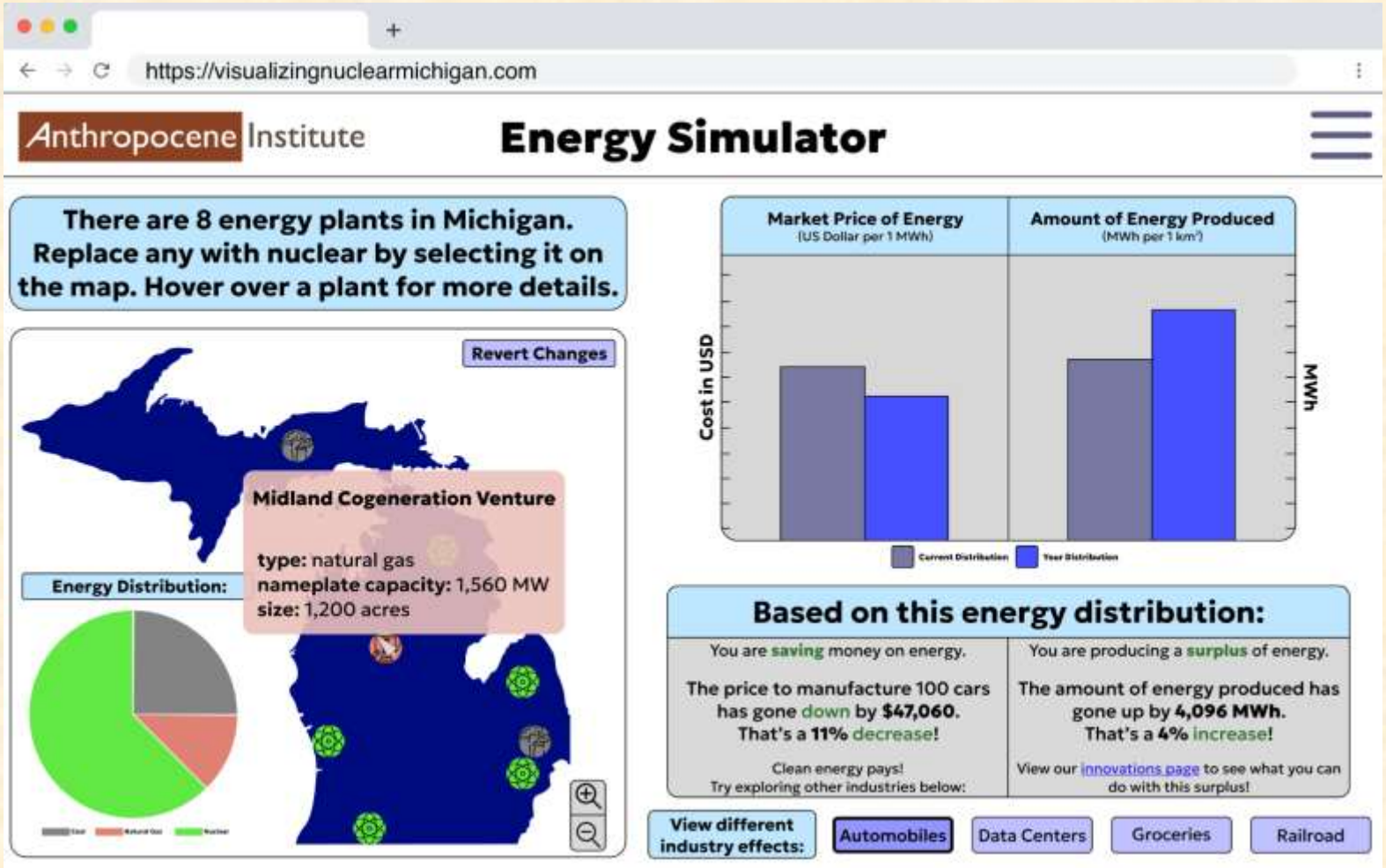
Project Design Specifications

- Users will be provided with an interactive map of Michigan with color coded dots representing coal, natural gas, and nuclear power plants, which they can hover over to view specifications
- Users will be able to click on any plant to change the energy source, which will then update information on the price and amount of energy produced, as well as the cost of energy in various industries
- Additionally, once nuclear plants have been added, users will be able to see their energy surplus and innovations it can be used on

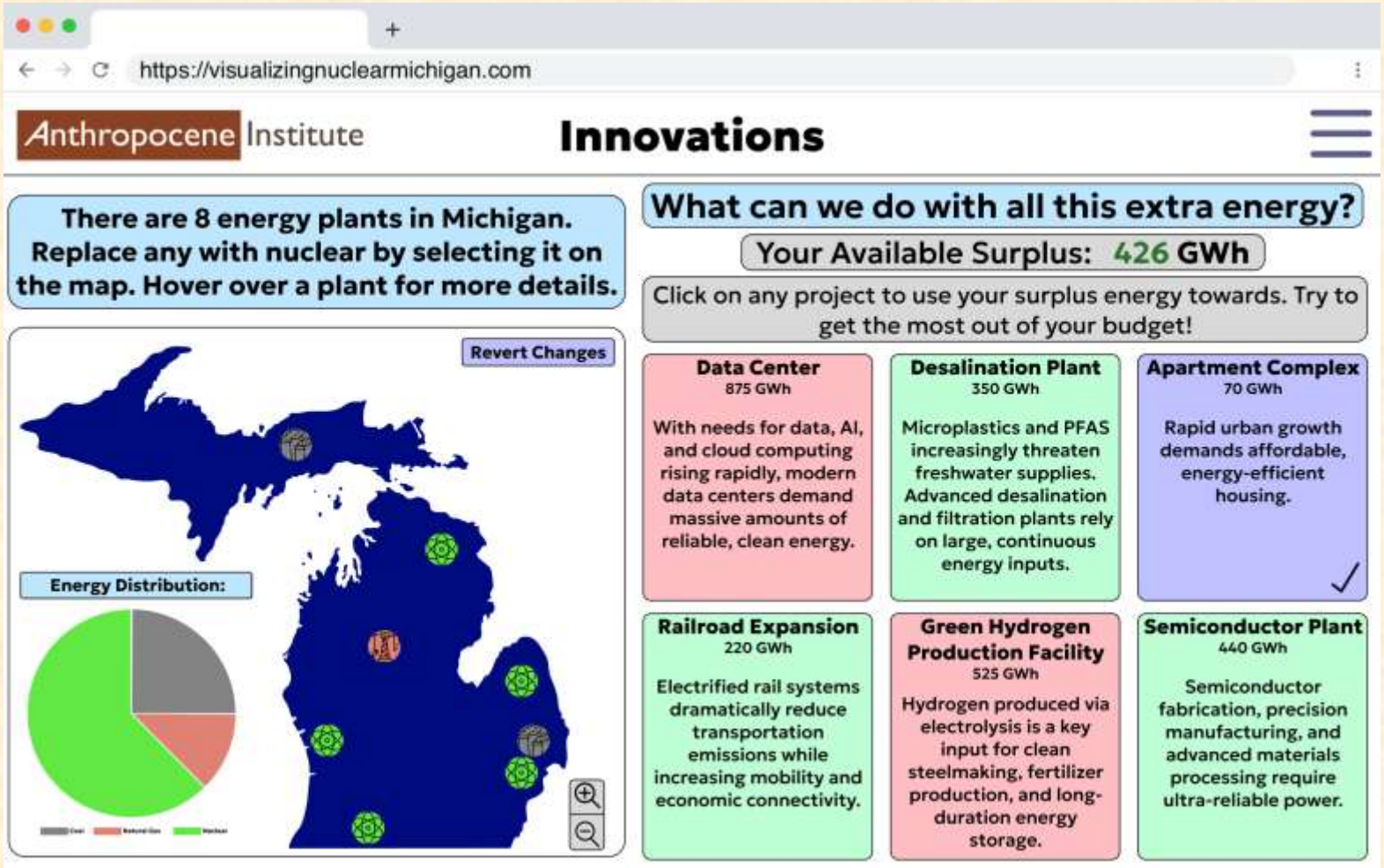
Screen Mockup: Initial



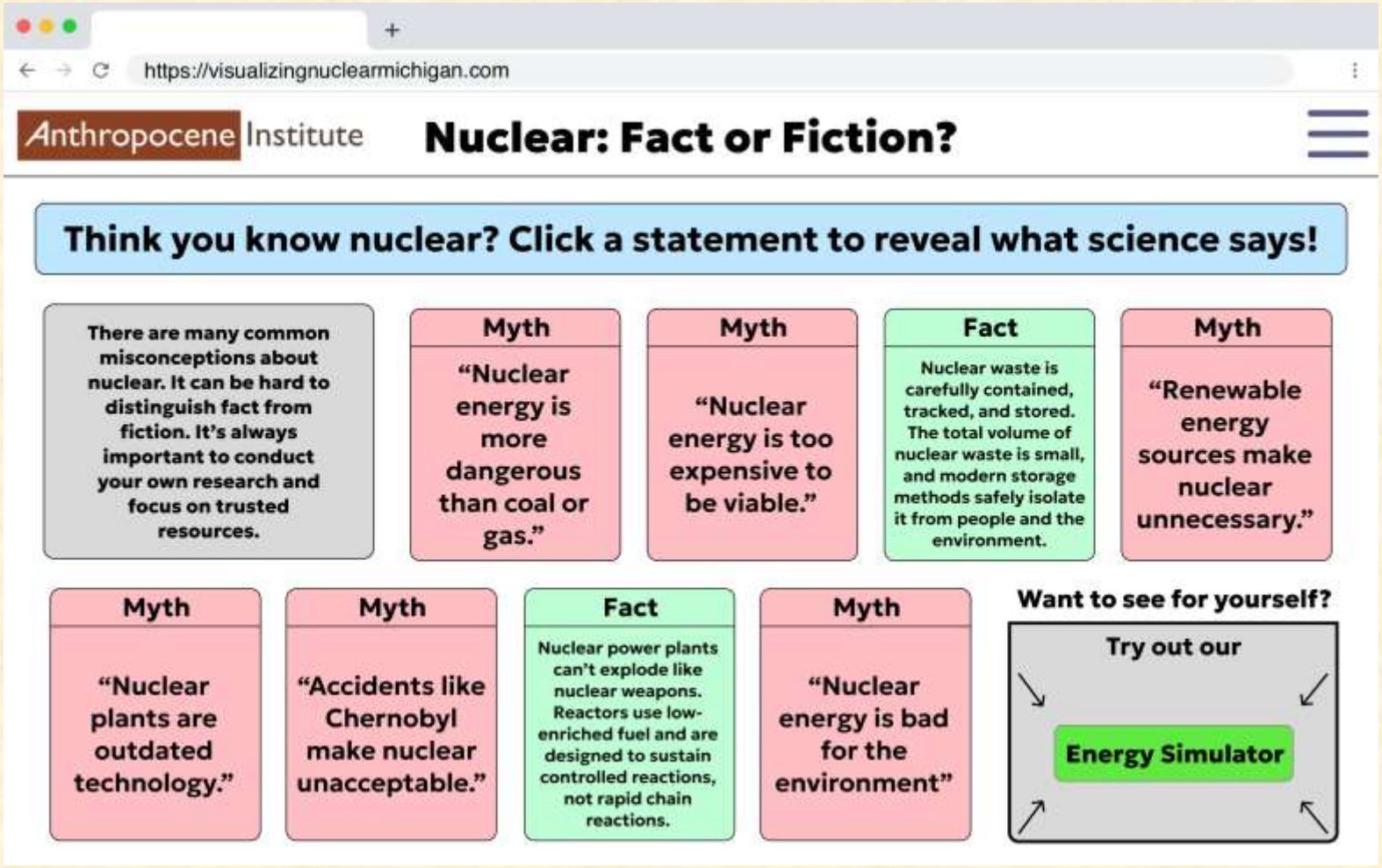
Screen Mockup: Increase



Screen Mockup: Innovations



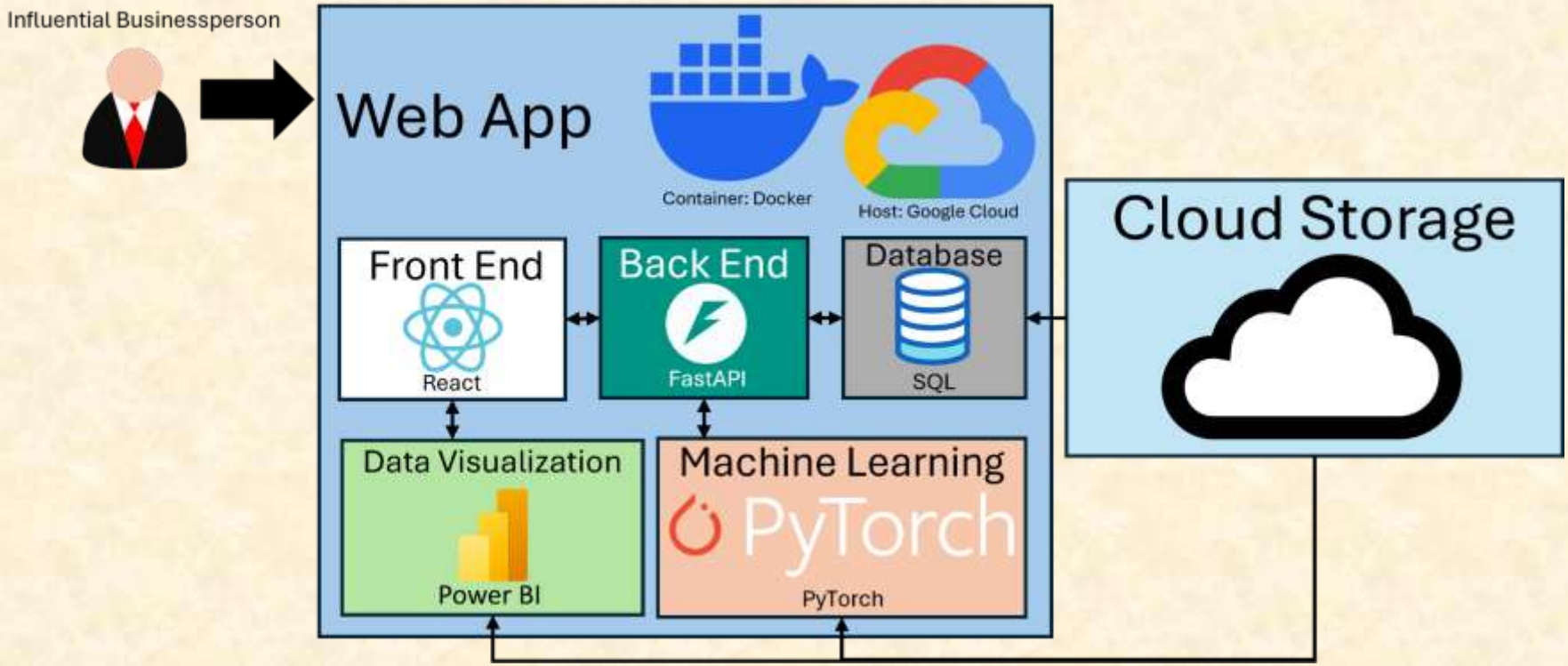
Screen Mockup: Trivia



Project Technical Specifications

- The user will interact with a front-end created in React, which will embed PowerBI for visualization and utilize FastAPI for the back-end
- The back-end will use an SQL database for data storage and make calls to our machine learning model to make energy price predictions
- The application will be containerized with Docker and deployed using the Google Cloud Platform

Project System Architecture



Project System Components

- Hardware Platforms
  - Personal Computer
- Software Platforms / Technologies
  - Docker – Containerization
  - Google Cloud – Deployment
  - React – Front-end
  - FastAPI – Back-end
  - SQL – Database
  - PowerBI – Data Visualization
  - PyTorch – Machine Learning

Project Risks

- Risk 1: Obtaining energy cost and consumption data
  - This data from different industries/energy sources may be difficult to find, especially in our desired granularity
  - As a team, we are gathering local data as well as international data. If data is not available, we will seek equally important data for other sectors
- Risk 2: Interactive map performance
  - This web app includes a large number of energy plants, so rendering all the points while also supporting hovering, selection, and replacement can lead to performance issues, especially in lower end devices
  - The intractability will be limited to relevant plants through a filtering system, and only certain plants can be hovered/selected. Performance testing will be conducted on a range of devices
- Risk 3: Seamless user experience
  - There may be a delay in updating predictions and energy visualizations in the map when the user adjusts energy resources, making the website seem unresponsive
  - FastAPI will be used to handle low latency requests, and, to ensure near instant updates, the machine learning model will be optimized for fast inference
- Risk 4: Developing an accurate machine learning model
  - If the model created does not accurately fit the data or does not capture key relationships in the data, the resulting predictions may mislead users or lack credibility
  - Multiple team members will evaluate different modeling approaches, which will then be compared with historic data, validation metrics, and scenario testing to determine accuracy

Questions?

