MICHIGAN STATE
U N I V E R S I T Y

Project Plan Presentation
Modeling Michigan's Energy Future

The Capstone Experience

Team Anthropocene

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From Students…
…to Professionals

Project Sponsor Overview

- **Who they are:** A mission-driven group that connects engineers, scientists, policy leaders, and investors to speed clean, reliable, affordable energy.
- **What they focus on:** Turning complex energy trade-offs into clear insights—spotlighting nuclear and grid electrification alongside environmental and health outcomes.
- **Why it matters to our project:** They sponsor our Michigan Energy & Health Dashboard, which unifies public data and surfaces citable KPIs on fuel mix, CO_2, prices, reliability, and health impacts.

Anthropocene Institute

Project Functional Specifications

- Michigan has abundant public energy data; the real need is to transform it into a clear, decision-ready story that links generation choices to costs, reliability, emissions, and health outcomes.

- Our project builds a Michigan-focused web dashboard that consolidates authoritative public data into a single, consistent, and citable view; it validates historical datasets and presents side-by-side comparisons so users can understand trade-offs quickly.

- The system supports scenario analysis, including retiring the largest coal plants and exploring clean firm replacement options.

- Results are sourced, exportable, and presentation-ready so students, community leaders, and policymakers can communicate trade-offs clearly and make informed decisions.
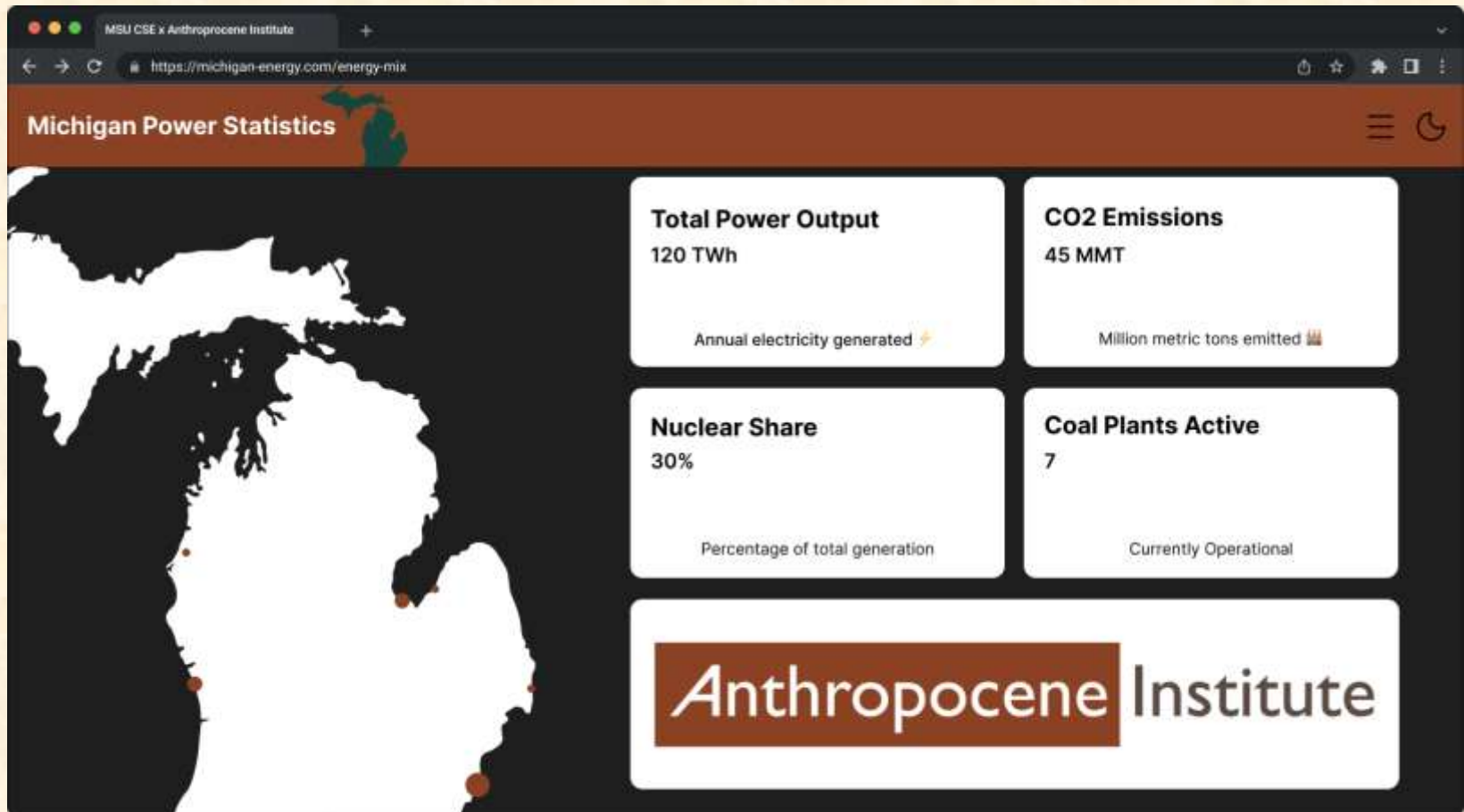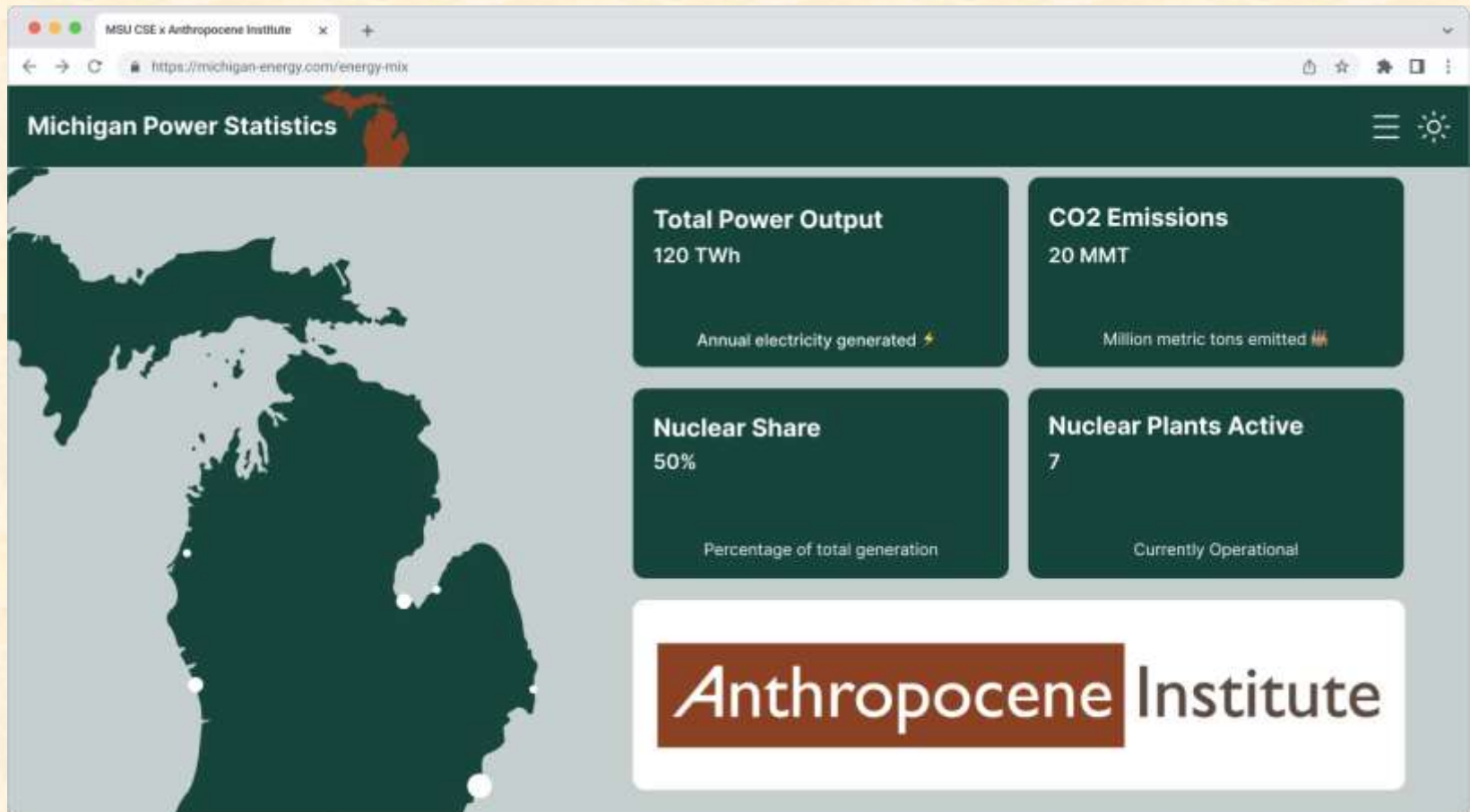.

Project Design Specifications

- Standalone web application

- Information on power plant pollution and economics

- Interactive map with Michigan's power plants

- Gamified version of changing types of power generation across the state

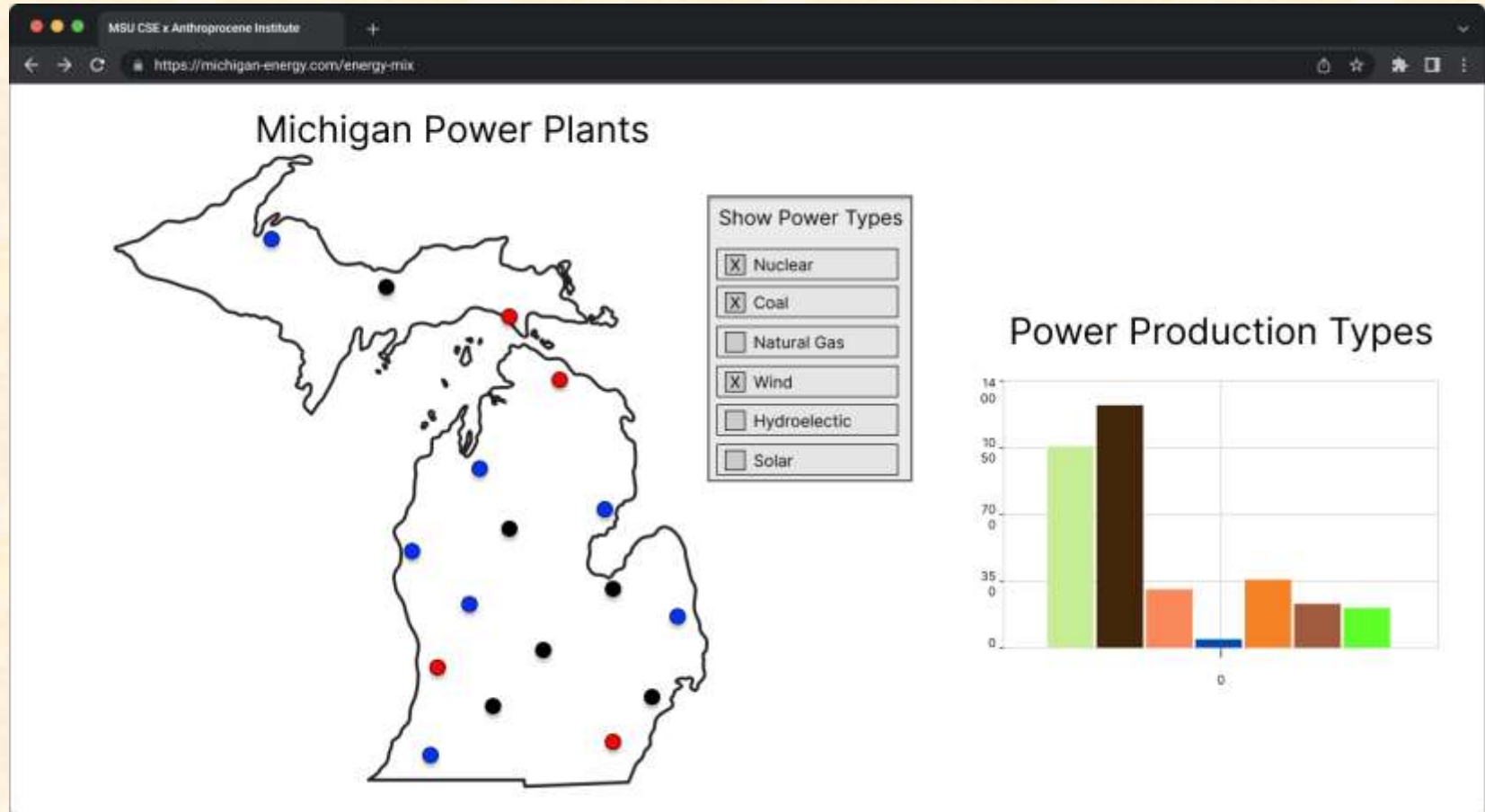# Screen Mockup: Current vs Future Energy Projection

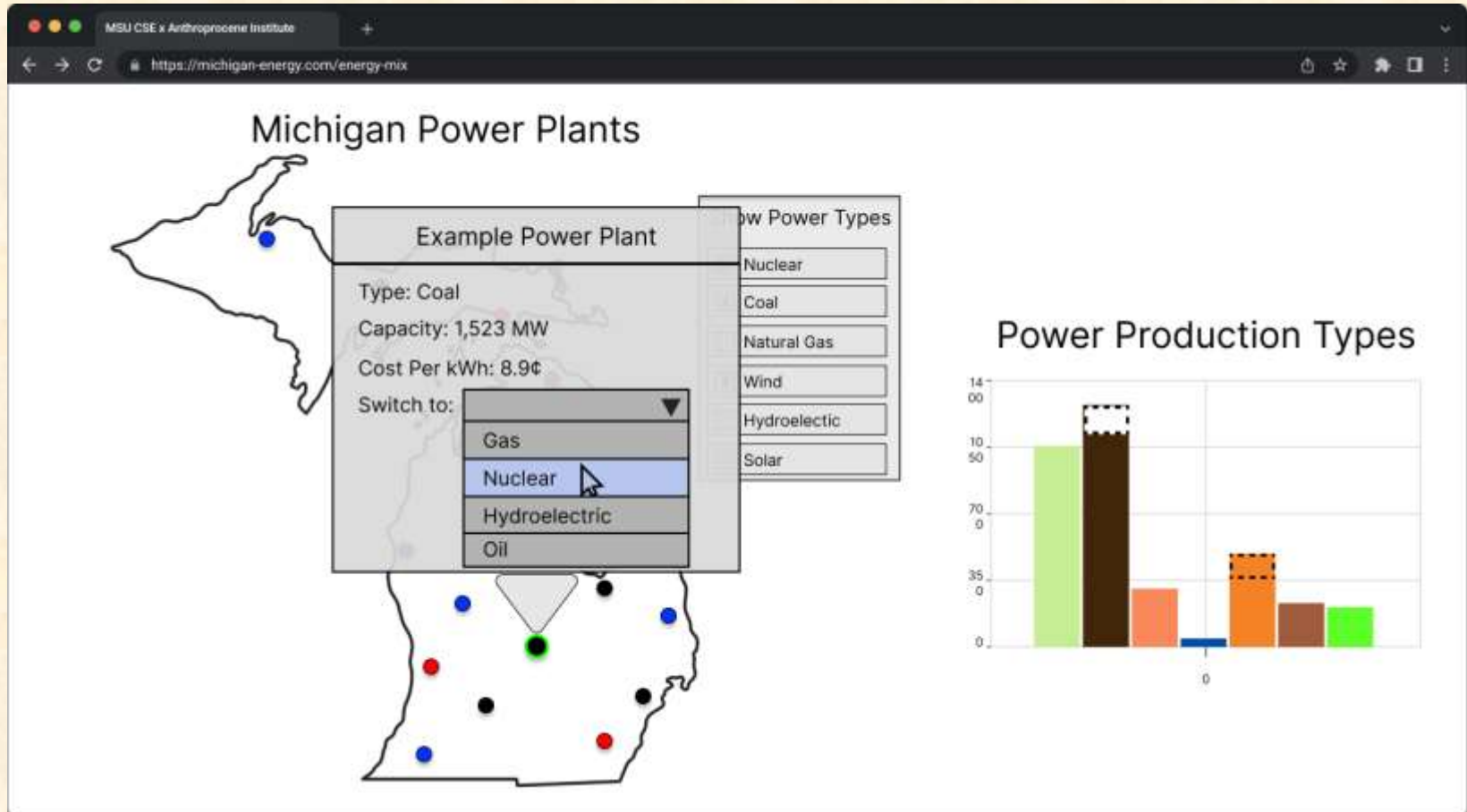# Screen Mockup: Current vs Future Energy Projection
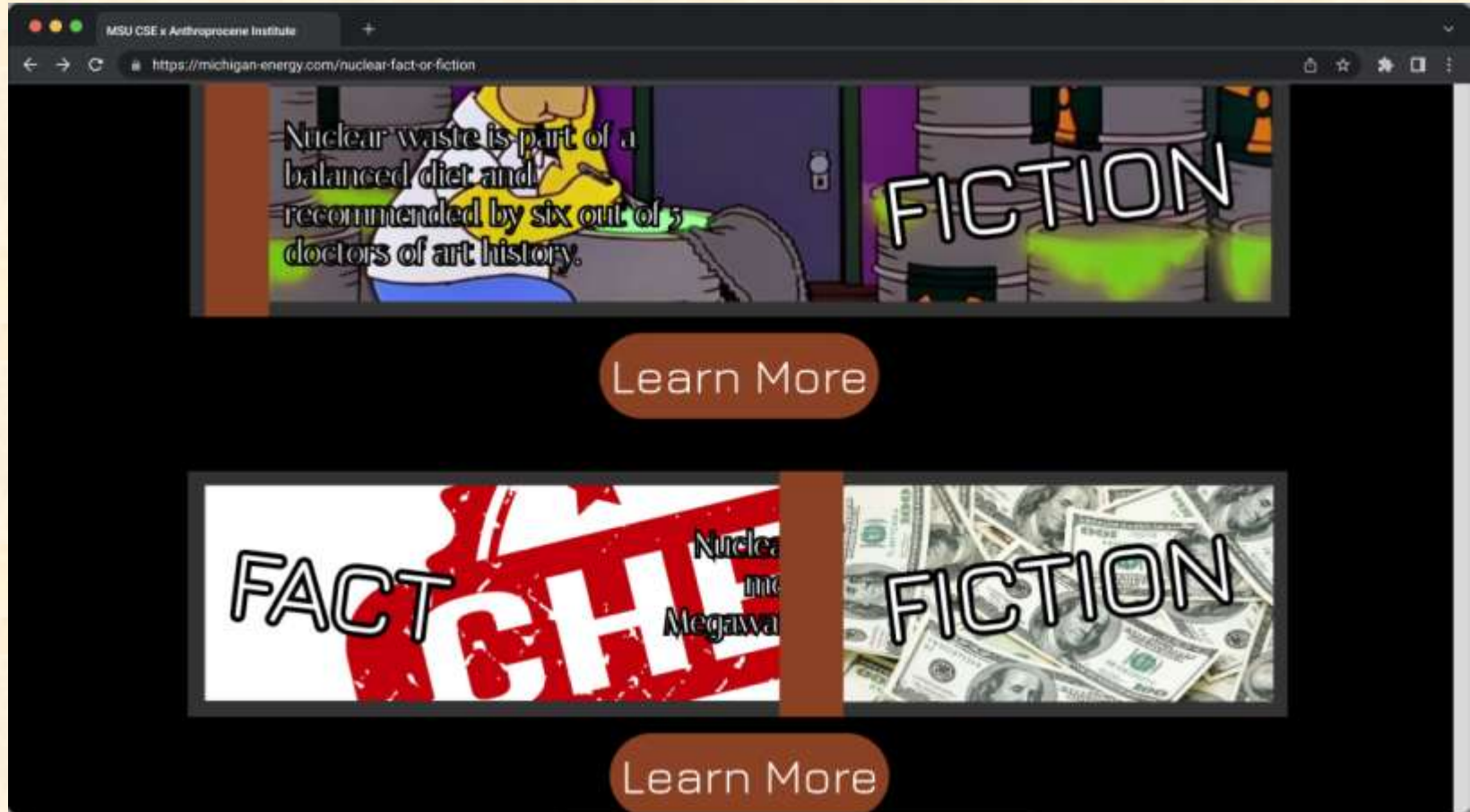
Screen Mockup: Interactive Map

Screen Mockup: Power Plant Dialog

# Screen Mockup: Nuclear Fact or Fiction

Project Technical Specifications

- **Next.js (React)**
  Next.js gives us a fast, modern React framework with routing and data-fetching; we use it to build the interactive dashboard UI (tables, filters, maps, charts) and serve the frontend during development.

- **Flask (Python)**
  Flask is a lightweight API framework that's quick to stand up; we use it to expose REST endpoints and to orchestrate data pulls/processing.

- **SQLite**
  SQLite is simple and zero-maintenance for local analytics; we store cached EIA pulls and facility-fuel tables to speed repeat queries and offline processing.

- **Requests (Python)**
  Requests is the straightforward HTTP client; we use it to call EIA endpoints with params and handle pagination/errors cleanly.

- **Leaflet / Mapbox GL JS**
  These mapping libraries are lightweight and widely used; we plot generator points (lat/lon), show capacity metadata in popups, and support filtering/clustering on the map.

- **Recharts / Chart.js**
  These charting tools make visual KPIs easy; we render fuel-mix, CO_2 trends, and price series with responsive, accessible charts.

Project System Architecture
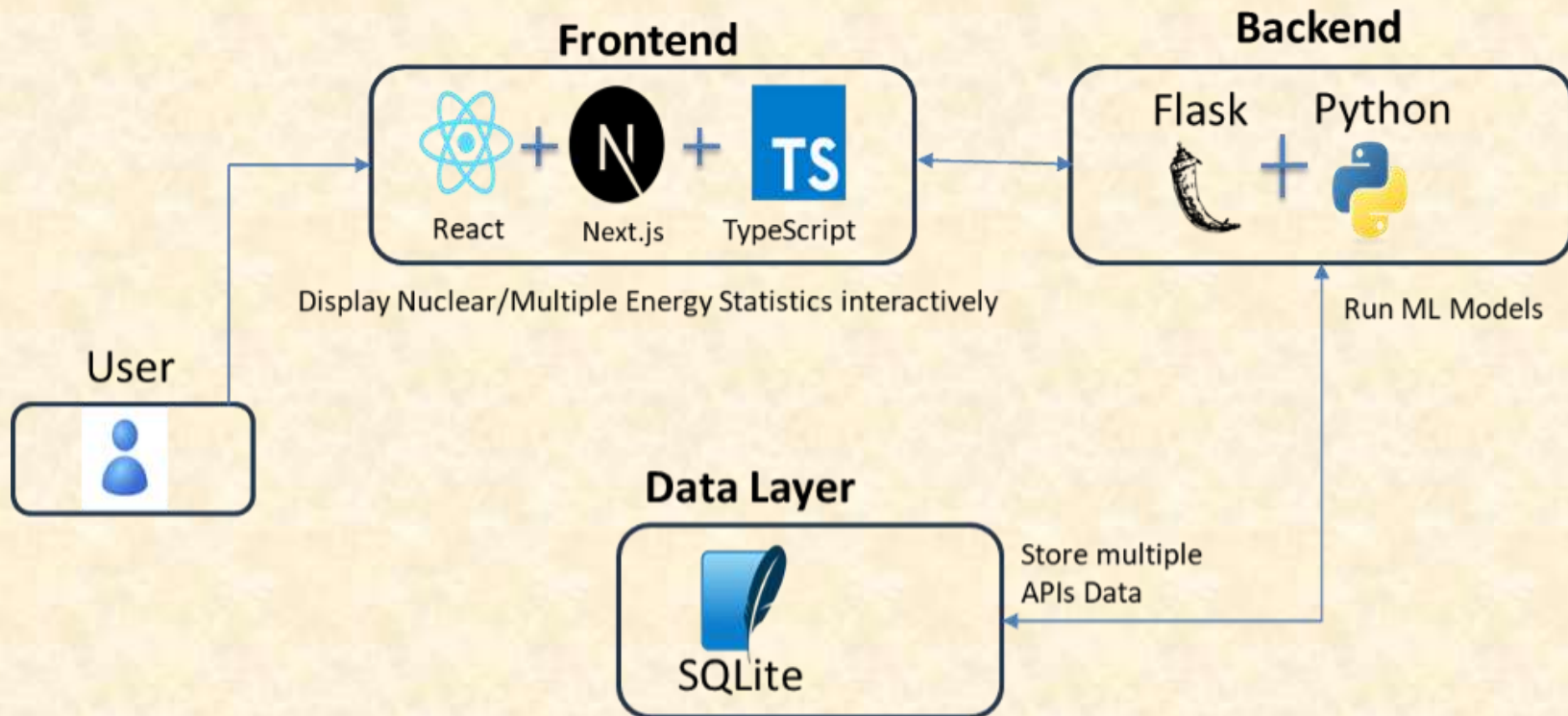
Project System Components

Software Platforms / Technologies

- **Frontend:** Next.js (React) + Node.js/npm

- **Backend:** Python 3.11 + Flask, Requests, Pandas

- **Database:** SQLite (eia_michigan.sqlite)

- **APIs/Datasets:** U.S. **EIA v2 API**

- **Dev tooling:** Git/GitHub, Homebrew (Node install)

Project Risks

- **Incomplete or Missing Data**
  - Not all counties/factories will have data available for us to use in our models.
  - If we are unable to source all appropriate datasets, we will statistically or algorithmically approximate.

- **Machine learning Model**
  - Unknown complexity and unsure of future projections
  - Build multiple models and talk to clients for their needs

- **Determining Health Impact**
  - Health effects of pollutants are complex and may not be directly measurable with available datasets
  - Use sponsor-provided estimates where direct data is missing, and clearly identify assumptions in the model

- **Complexity of Interactive Model**
  - The interactive features like map rendering, scenario simulations, and real-time feedback may be more technically challenging than anticipated.
  - Prioritize core functionality and treat advanced features as stretch goals, testing incrementally as we go

Questions?