

BURNIN' UP TECHNICAL REPORT

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OUR STORY

Earth's climate is changing faster than ever. The emission of pollutants in the air can result in serious changes to the climate. These pollutants can be extremely dangerous with harmful effects for public health, ecosystems, and agricultural productivity. We want people to realize how serious the issue is by showing data that captures the impact of climate change around the world. We hope that our website shows a clear picture of how fast and how far the climate has changed around the world in the past decades and encourages people to take action to help the environment.

1. Project Overview

This website aims to educate people on the climate crisis of our planet, and make them aware of how quickly our home is changing. This website will allow the user to navigate from city to city, or country to country, to see how each city or country is contributing to, or has been affected by climate change. Users can also see how climate change has been affecting the world on a year by year basis. We hope to encourage our users to take action by making small changes in their lives to decrease their individual carbon footprint, such as turning off lights they aren't using, or carpooling with others when they can.

2. User Stories

Phase I User Stories

Look up air quality data for a city

“As an environmental activist, I'd like to know the air quality of various cities around the world to make a case for reducing carbon footprint.”

Observe historical trends within global climate change

“As an environmental science professor, I want to know the level of greenhouse gases globally during any given year to teach my students about historical trends in global climate change.”

Suggest related locations for comparing climate trends

“As a concerned resident of an urban area, I'd like to know about the air quality level in my city and other cities in my country. For instance, when I'm looking up the air quality level in my city, I'd like to view several related locations so I can compare my situation to residents of those areas.”

Examine the relationship between air quality and economics

“As an environmental researcher, I'd like to view the air quality as well as information about the economic situation (GDP, electricity, etc.) of a given country to investigate relationships between these factors.”

Examine the relationship between air quality and demographics

“As a sociologist, I'd like to know the air quality and demographic information (population, etc.) in a given city to understand how these factors are related.”

Phase II User Stories

- Shift location of countries table: I'm an environmental activist returning to use your website. I clicked on the link for the main page for countries and I could only see the global map. Although the map is cool, I would prefer to see the country table at the top of the page so I can find it immediately!
- Add units of measurement for categories of information: I'm a resident of an urban area and a returning user to your website. I find it slightly difficult to understand what some of the values in your tables for your models mean. Please add units of measurement on your columns to help understanding!
- Adapt website to look good on mobile devices: I'm an employee of a company that makes electrical cars, and I was trying to use your website on my phone but I found that the layout is very disorganized. I would appreciate it if you made the website adaptable to different types of devices, no matter the size or shape of the screen.
- Add spacing around elements: I'm an environmental science professor using your website and thought it would look nicer if all the elements had a bit more spacing around them (bootstrap classes m-x and p-x) rather than everything being tightly packed together (Example: city, county, and climate change filters).
- Improve Filtering Options: I'm an environmental researcher. While using your website, I thought it would be helpful if you added some kind of improvement to filtering options (ex. custom value entry, sort the timezones dropdown correctly).

Phase II Customer Stories

- Add a search and filter bar to Vehicles/Fueling Stations: As someone who is looking for an energy-efficient car, it would be nice to be able to sort by different preferences to find different models and fuel locations. Currently, there is no available option to sort. I would like to sort by annual fuel cost, CO2 emissions, and savings.
- Modify Energy Sources page to not have a dropdown and instead have a general page with links to instance pages: I am researching vehicle energy consumption. The dropdown menu doesn't seem to be the best way to display all of the different energy sources especially if I want to click on one way down in the list. I think it would be much easier and convenient to have a common page which gives me an overview of the types of energy sources at once.
- Embed the map on each fueling station instance page: As a user who is trying to compare the locations of different service stations near me, I think it would be nice to see the map of where each service center. It would be better for quick visual comparisons. You could possibly make the link to the map bigger and more visible but it would be more engaging to have a map.
- For the Home page, make purpose of the site more obvious: As a first time user, I feel a little lost as to what the website is for. I think emphasizing the page's purpose on the home page would help me understand more. This could be put possibly after the carousel or on the carousel with informational photos,
- Add dividers and links to the API's/Datasets you used: As someone who is doing research on energy-efficient vehicles, I would like to see more clearly the sources that you used to populate your data. Adding in clearer dividers as well as specific links to the APIs and datasets you use would help me get more information. This can be done in the about page, and maybe in the models general page.

3. RESTful API

We used Postman to design our API. Our API documentation can be found [here](#).

Countries API Endpoints

- **GET all countries**
burninup.me/api/countries
Returns a list of all the countries in our database with basic information on the country, such as capital city, country income, latitude and longitude, region, and the most recently recorded carbon emissions for that country.
- **GET countries by country id**
burninup.me/api/countries/id=<id>
Returns the information of a country given the country id, such as capital city, country income, latitude and longitude, region, and the most recently recorded carbon emissions.
- **GET year with the highest carbon emissions for each country**
burninup.me/api/country_year
Returns the year with the highest carbon emissions for each country. This returns the year, country, year, and carbon emissions for that year.
- **GET year with the highest carbon emissions for each country by country name**
burninup.me/api/country_year/name=<name>
Returns the year with the highest carbon emissions for a country given the country name. This returns the year, country, year, and carbon emissions for that year.

Cities API Endpoints

- **GET all cities**
burninup.me/api/cities
Returns a list of all the cities in our database with basic information on the city, such as population, latitude and longitude, and country code, as well as climate data such as carbon monoxide level, ozone concentration, and particulate matter of 10 and 25 microns in diameter.

- GET city by city id**
 burninup.me/api/cities/id=<id>
 Returns the information of a city given the city id, such as population, latitude and longitude, and country code, as well as climate data such as carbon monoxide level, ozone concentration, and particulate matter of 10 and 25 microns in diameter.
- GET city by city name**
 burninup.me/api/cities/name=<name>
 Returns the information of a city given the city name. This information includes basic information such as population, latitude and longitude, and country code, as well as climate data such as carbon monoxide level, ozone concentration, and particulate matter of 10 and 25 microns in diameter.
- GET city names**
 burninup.me/api/cities/city_names
 Returns a list of all the city names we have in our database.
- GET hottest year for each city**
 burninup.me/api/city_year
 Returns the hottest average temperature for each year and for each city. This returns the city, year, country, city id, country id, latitude and longitude of the city, and average temperature.
- GET hottest year for each city by city name**
 burninup.me/api/city_year/name=<name>
 Returns the year with the hottest average temperature for a city given the city name. This returns the city, year, country, city id, country id, latitude and longitude of the city, and average temperature.
- GET country code and name by city id**
 burninup.me/api/<city_id>/country_code
 Returns the country code and country name of a city given the city id.

Years API Endpoints

- GET all years**
 burninup.me/api/years
 Returns a list of all the years in our database. This information includes yearly statistics such as the temperature anomaly, carbon dioxide level, polar ice extent, and world population of that year.

- **GET years by year name**
burninup.me/api/years/name=<name>
Returns the statistics of a year given the year name. This information includes statistics such as the temperature anomaly, carbon dioxide level, polar ice extent, and world population of that year.
- **GET country carbon emissions per year**
burninup.me/api/country_emissions
Returns every country's carbon emissions per year. This request includes the year name, country, country code, and carbon dioxide emissions.
- **GET average city temperature per year**
burninup.me/api/city_temperatures
Returns every city's average temperature per year. This request includes the year name, city, city id, country, average temperature, and latitude and longitude of the city.
- **GET capital city id by country id**
burninup.me/api/<country_id>/capital_city_id
Returns the id of a capital city given the id of the country it belongs to.

4. Models

Countries

- Name
- List of Cities
- Population
- Flag
- Climate (Air Quality)
- Income level
- Region
- Subregion

Cities

- Name
- Population
- Country
- Location
- Climate (Air Quality)
- Historical Weather

Global Climate Change by Year

- Year
 - Global Mean surface temperature anomaly
 - Global Temperature
 - Carbon Dioxide Levels
 - Methane
 - Nitrous Oxide
 - Top 10 highest temperature cities for each year
 - Top 10 highest co2 emission countries for each year
 - Ice Extent
-

Filterable/Sortable Attributes:

Countries: name, primary language, region, currency, population

Cities: name, country, time zone, location, population

Global Climate Change: carbon dioxide levels, global temperature, years, nitrous oxide levels, months

Searchable Attributes:

Countries: GDP, subregion, list of cities, flag, air quality

Cities: zip codes, elevation, location, air quality, historical weather

Global Climate Change: UV indices, world population, polar ice, decade, century, sea level

Media:

Countries: photos of flags, graphs, tables, maps

Cities: pictures, descriptions, tables, maps

Global Climate Change: tables, maps

Connections:

Country: Connects to city because countries have cities, and the air quality in cities contributes to air quality in a country. Connects to global climate change because the quality of air depends on carbon dioxide emissions globally.

City: Connects to countries because cities are in countries and contribute to the air quality of a country. Connects to global climate change because the air quality of a city depends on carbon dioxide emissions and can result in increasing climate change globally.

Global Climate Change: Connects to countries because air quality in countries affects global climate change. Connects to cities because air quality in cities affects carbon emissions globally.

5. Tools

Backend

- Elastic Beanstalk: Used to host backend API.
- AWS Cloudfront: Used to deploy our website.
- AWS RDS: Used to host the tables for our models.
- Postman: Used to test and document our API.
- NameCheap: Used to get a free domain name.

Frontend

- React: Used to render website and connect the user interface to the backend.
- React Bootstrap: The CSS framework used for the website.
- Selenium: Used to test GUI of website.
- Jest: Used to test React and Typescript components and functions.
- AWS S3: Used to host the static website.

Data

- Google Places API: Used to get images of the cities and countries.
<https://developers.google.com/places/web-service/photos>
- Google Geo Location API: Used to map cities and countries.
<https://developers.google.com/maps/documentation/javascript/overview>
- World Bank API: Used to get general information on countries.
<https://datahelpdesk.worldbank.org/knowledgebase/articles/898599-indicator-api-queries>

- OpenDataSoft WorldCitiesPop API: Used to get the population of cities.
<https://public.opendatasoft.com/explore/dataset/worldcitiespop/api/?disjunctive.country&sort=population>
- Google Geocoding API: Used to get latitude and longitude of cities.
<https://developers.google.com/maps/documentation/geocoding/overview>
- Air Quality Programmatic API: Used to get air quality data on different cities.
<https://aqicn.org/api/>
- Countries Cities API: Used to get basic information on cities.
<https://rapidapi.com/natkapral/api/countries-cities>
- Global Warming API: Used to get climate data for temperature anomalies.
<https://global-warming.org/>
- Carbon Emissions Dataset: Used to get global carbon emissions from 1880-2019.
<https://data.giss.nasa.gov/modelforce/ghgases/Fig1A.ext.txt>
ftp://aftp.cmdl.noaa.gov/products/trends/co2/co2_annmean_mlo.txt
- Methane Dataset: Used to get global methane levels from 1880-2019.
ftp://aftp.cmdl.noaa.gov/products/trends/ch4/ch4_annmean_gl.txt
- Nitrous Oxide Dataset: Used to get global nitrous oxide levels from 1880-2019.
<ftp://ftp.ncdc.noaa.gov/pub/data/paleo/icecore/antarctica/law/law2006.txt>
https://www.epa.gov/sites/production/files/2016-08/ghg-concentrations_fig-3.csv
- Polar Ice Dataset: Used to get polar ice extent from 1880-2019.
- Sea Level Dataset: Used to get global sea levels from 1800-2018.
<https://www.jpl.nasa.gov/edu/teach/activity/graphing-sea-level-trends/>
- World Population Dataset: Used to get the world population from 1800-2019.
<https://ourworldindata.org/world-population-growth>

6. Hosting

We got the domain name from NameCheap, and then used a Custom DNS to connect our NameCheap domain to the nameservers provided to us by Route 53 on AWS. We hosted our files on AWS using a S3 bucket, and pushed our docker image to an AWS Elastic Beanstalk instance so we could run our code. We then routed our frontend to our backend using AWS CloudFront, which connects our NameCheap domain, S3 bucket, and Elastic Beanstalk instance.

7. Gitlab

<https://gitlab.com/caitlinlien/cs373-sustainability>