CO2 Emissions

1999-2014

Brian McLane, Greg Behnke, Katharine Hollars, Steve Reiss

Goals / Hypotheses

Goals:

The COP26 Summit and recent weather-related events have focused attention on the health, political, economic, and national security implications of climate change.

A key global climate change initiative was the 2015 Paris Accords, the first time that most of the world's leading countries came together to address the topic.

Global climate change is being driven by CO2 emissions. We've created visualizations to examine CO2 data from the years 1999 to 2014 - a period when emissions increased significantly - to better understand what world leaders knew as they participated in the Paris Accords.

Hypotheses:

1. There are over 200 countries being tracked in our DB. Our hypothesis was that CO_2 emissions were primary driven by a handful of larger countries. This was confirmed by additional sources.

2. We hypothesized that certain top 30 countries – primarily China – have contributed an increasing percentage of the emissions, paralleling / tied to their dramatic economic growth.

3. We hypothesized that certain countries who are not top of mind might be included in this group – who we are calling "the Dirty 30".

ETL

ETL:

Our ETL goal is to simplify the dataset

- Dropping bunker fuels (not included in total)

- Reducing the size of the database for faster response (Using years 1999 – 2014

- Focusing on top countries who contribute most of the emissions

- Next tier: breaking data into regions – e.g. Middle East

- Next tier: including data on domestic fossil fuel production, haven't found a good source yet

ETL:

Our Data was Consumed as Follows

- Our primary emissions data originated as a .csv file at DataHub.io by DATOPIAN: https://datahub.io/core/co2-fossil-by-nation#data

- Initial data extraction and cleaning was done in Jupyter Notebooks with additional steps performed in PostgreSQL

- Final filtered data produced a table of the top 30 CO2 emitting nations by combined total

- We utilized Flask, HTML, CSS, JS and graphics (Leaflet, Plotly, D3, chartJS) to display our findings

ETL:

Data Challenges

- In our file, countries have changed / countries have merged (e.g. USSR vs. Russia and Ukraine, Germany vs. Democratic Republic of Germany)

- We used data from 1999 onward to reduce complexity and avoid confusion

Deployed Infrastructure

Deployed Infrastructure:

- Currently runs locally

- The goal is to deploy on Heroku

Deployment Learnings…

Deployment Learnings:

- Our data was not too big for PostgreSQL. But adding further contextual visualizations (e.g. volcanos, deforestation) might exceed the limitations of the free services

- Issues related to name changes with different nations. We reduced our dataset
  - We were originally thinking of last 50 years, but changed to last 15 years of data only – this changed our leading CO_2 emitter

- Was this harder than expected?
  - "You showed us a flame. You explained how steel is forged. Then you asked us to create an internal combustion engine. Oh … and then you mentioned Heroku – whaaaaaa?"

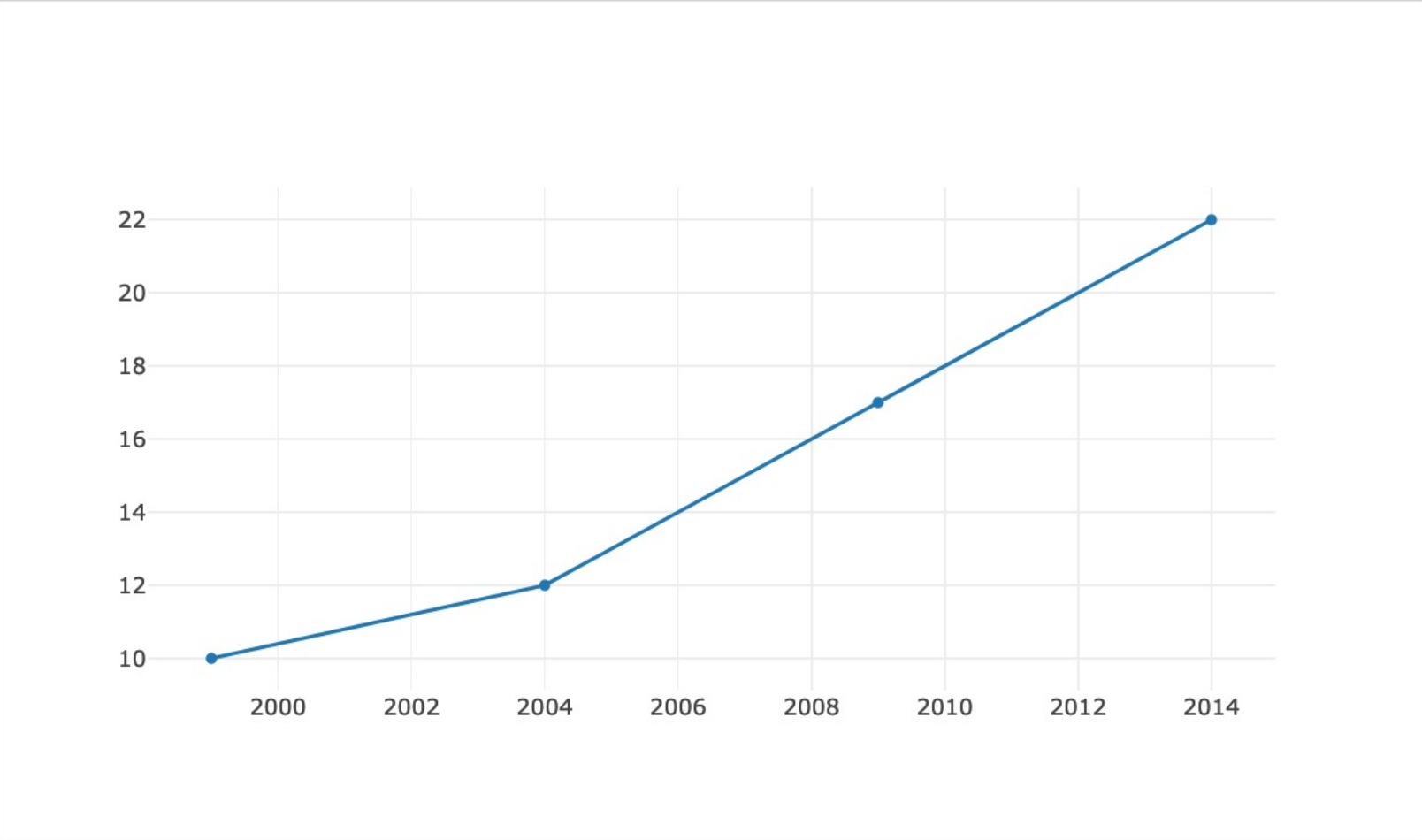# Website

Website Structure

- Served by a Flask app

- Three main pages

  - Home / index: key landing page including two data visualizations

  - Map: "Dirty 30" coded map and background on CO2 emissions

  - About: why we created this site, including headshots and links to git repositories for project team members

- CSS used for consistent formatting

- JS used for visualizations

  - Map: creating our interactive map

  - Index: creating our interactive charts (line and stacked bar)

  - Config: API key for map
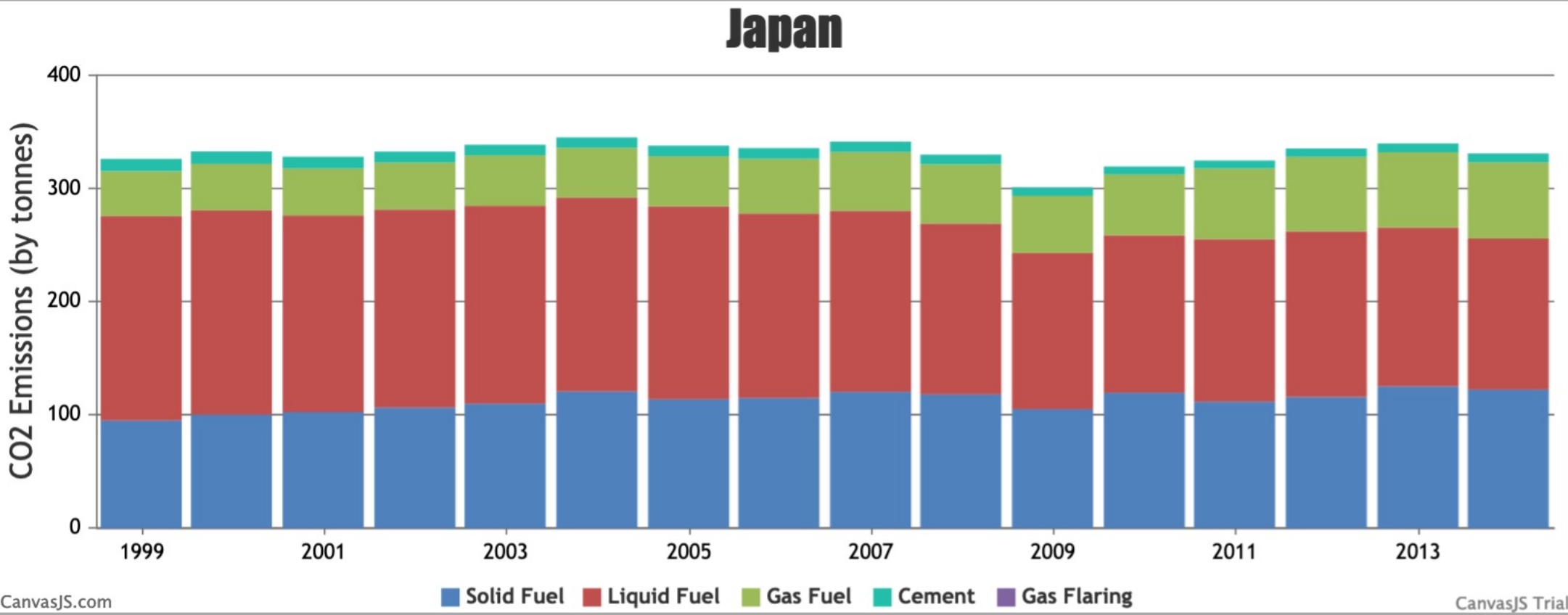
- JSON to hold data

Our Planned Webpages...

CO2 EMISSIONS 1999 - 2014

See the charts below and click on our other pages to learn more!

Increasing CO2 Emissions by Year

CO2 Emissions by Country and Type

Japan

CO2 Emissions (by tonnes)

400

300

200

100

0

1999   2001   2003   2005   2007   2009   2011   2013

CanvasJS.com

■ Solid Fuel ■ Liquid Fuel ■ Gas Fuel ■ Cement ■ Gas Flaring

CanvasJS Trial

Links to additional CO2 data sources

Top 10 Countries by Emissions   Greenhouse Gas Emissions   Countries and Emission Reduction Activity
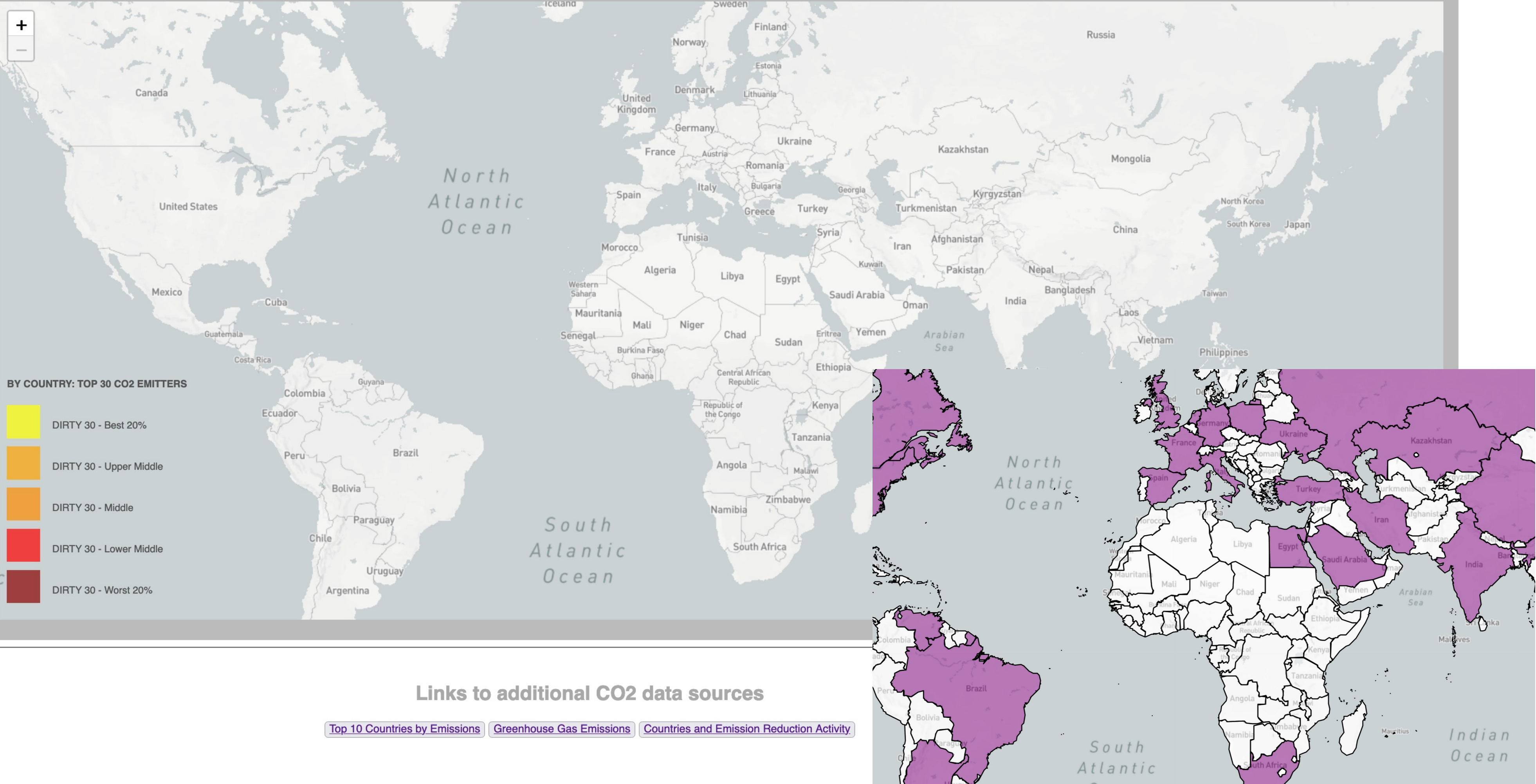
CO2 Emissions Map

About CO2

While CO2 is part of life — plants need it to grow — too much can be a bad thing, leading to measurable increases in things like global warming

Extra CO2 in the atmosphere increases the greenhouse effect as more thermal energy is trapped by the atmosphere, causing the planet to become warmer than it would be naturally

The U.S. EPA considers CO2 to be a pollutant because of it's role in propagating climate change, not because of any direct health effects

The annual rate of increase in atmospheric CO2 over the past 60 years is about 100 times faster than previous natural increases, such as those that occurred at the end of the last ice age (11,000-17,000 years ago)

The Dirty 30: 87% of all human-produced CO2 emissions come from the burning of fossil fuels like coal, natural gas and oil - with approximately 90% of this from 30 countries

BY COUNTRY: TOP 30 CO2 EMITTERS

DIRTY 30 - Best 20%

DIRTY 30 - Upper Middle

DIRTY 30 - Middle

DIRTY 30 - Lower Middle

DIRTY 30 - Worst 20%

Links to additional CO2 data sources

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ABOUT THIS PROJECT

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MEET OUR TEAM

Brian

Greg

Katharine

Steve

Links to additional CO2 data sources

Top 10 Countries by Emissions | Greenhouse Gas Emissions | Countries and Emission Reduction Activity

Live Demo
Our Current Status...

Next Steps, WrapUp and Closing Thoughts…

Next Steps and Closing Thoughts

- Next Steps:

  - Visualizations with interactive capabilities – by country, year, region, type of emissions, etc.

  - Make our map an interactive heatmap

  - Identify and layer in related data as appropriate – deforestation, climate pledges, domestic fossil fuel production, etc.

  - Hosting – Heroku?

- Closing Thoughts:

  - Greater team alignment related to planning our product, process, responsibilities, scope, timelines, deliverables - in some cases our expectations were not consistent

  - More consistent team communications (and consensus) during the project (progress, challenges, suggested workarounds, when we needed external help, etc.)