Project Proposal: Mapping Carbon Capture Ready US Power Plants
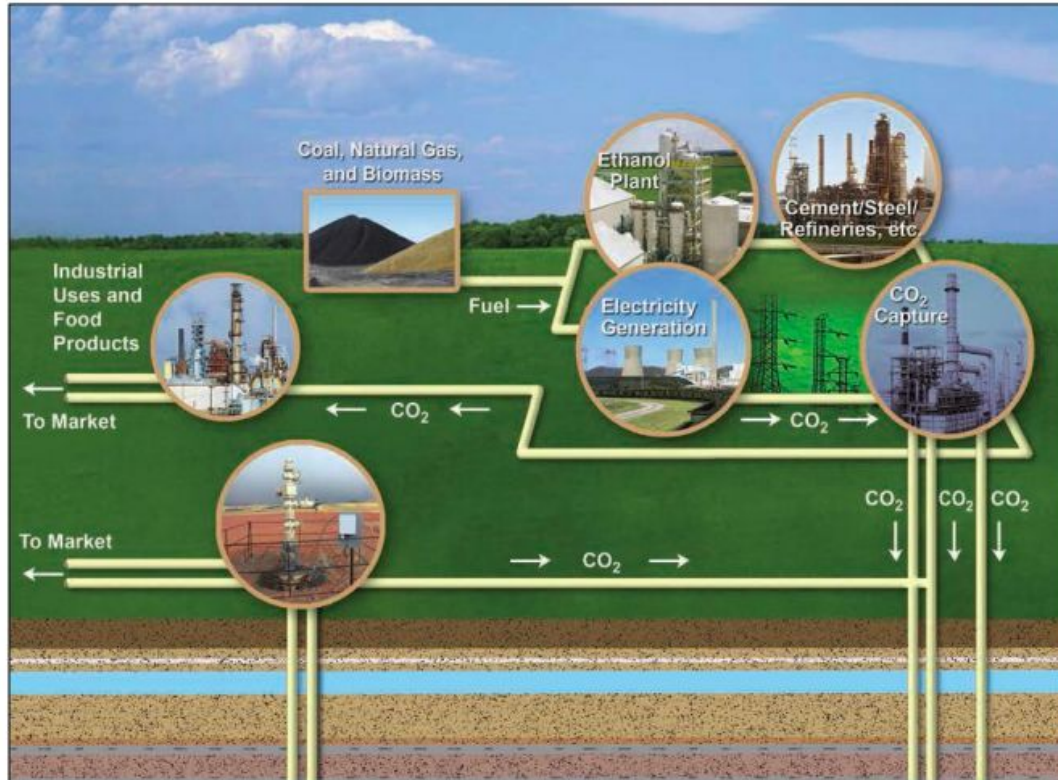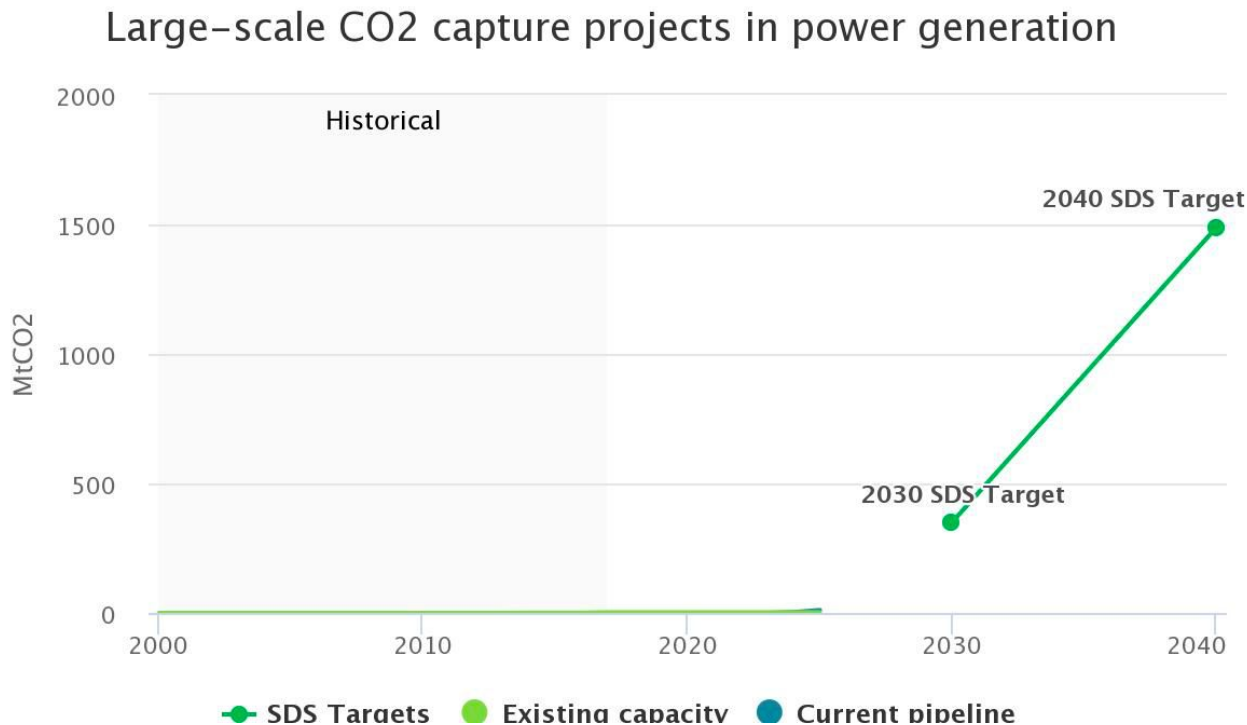
By: Lucas Kelly

What is Carbon Capture and Storage (CCS)?

Tremendous Need for Increased CCS Technology

Large–scale CO2 capture projects in power generation

Source: iea.org

Proposed Analysis and Goals

STEP 1:

<u>Goal</u>: Identify top power plants ready to adopt CCS based on a scoring system.

<u>Technique</u>:

- Web scraping
- API utilization (Google Maps)
- Naive Bayes Classification (Identify potential and no-potential plants)
- Adding on to existing database

Proposed Analysis and Goals

STEP 2:

Goal: Create a visualization of all US power plants (coal, oil, gas), and their score along with general plant details.

Technique:

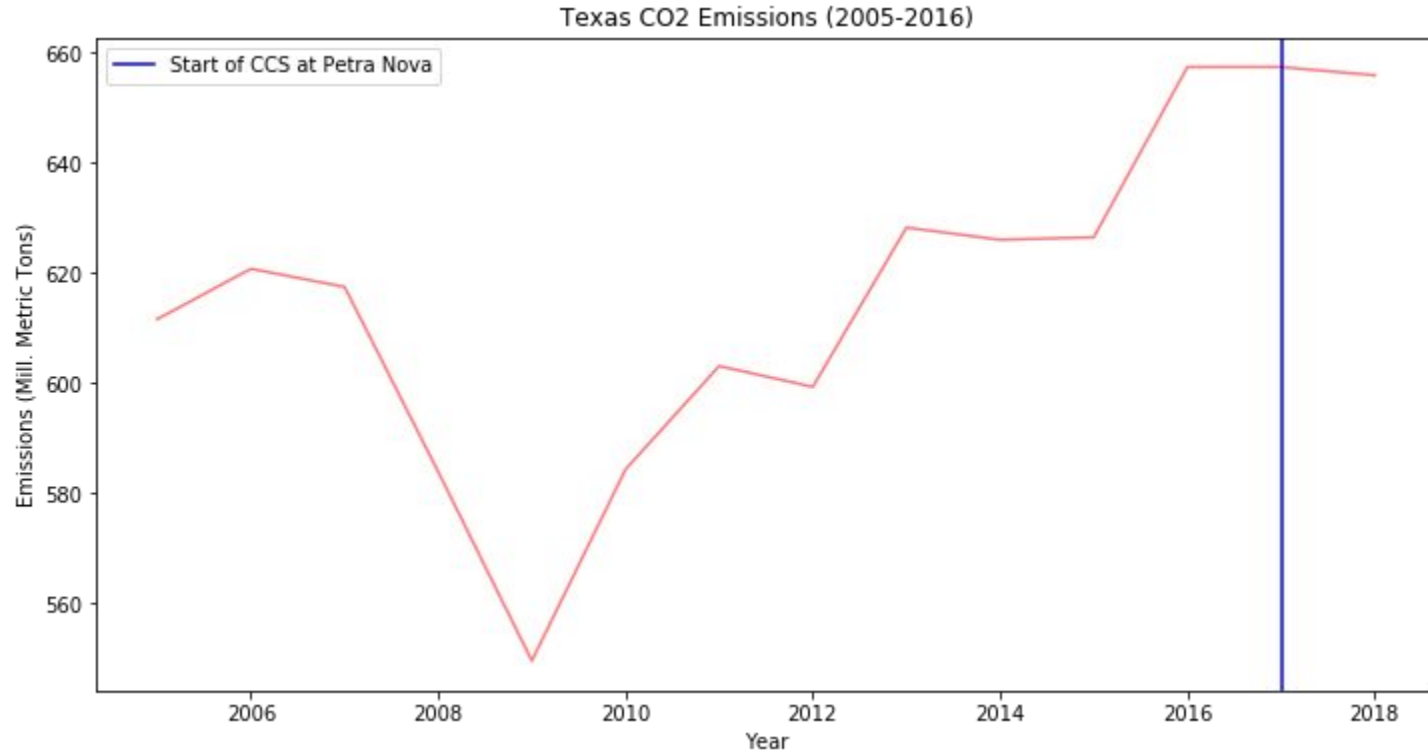- Visualization utilizing folium

Proposed Analysis and Goals

STEP 3:

<u>Goal</u>: Validate results of classification by running existing CCS plants through model.
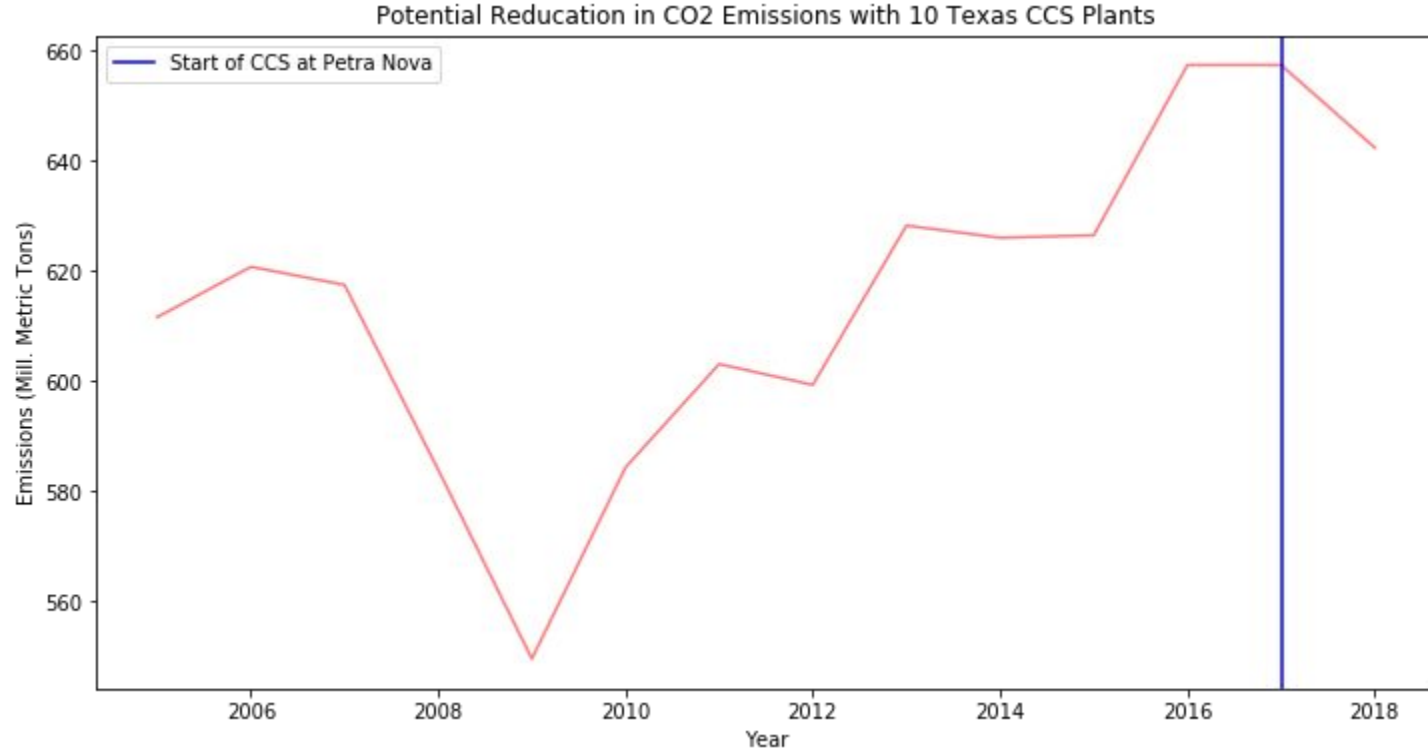
<u>Technique</u>:

- Validation
- Train-Test-Split

EDA: CCS in 1 Texas Plant

Texas CO2 Emissions (2005-2016)

EDA: CCS in 10 Texas Plants

Potential Reducation in CO2 Emissions with 10 Texas CCS Plants

Further Work

- Create a model that can predict efficiency and CO2 emission reduction for individual power plants.
- Apply the classification and model to international plants.
- Find data for yearly emissions by power plant.
- Consider the usage of A/B testing to see if CCS changes have an influence on global demand for CO2 emission reduction.
- Create a model that shows power plant profit from CCS.

Thank You

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References

The Carbon Capture and Storage Association: http://www.ccsassociation.org/what-is-ccs/

The Center for Climate and Energy Solutions:
https://www.c2es.org/2014/04/natural-gas-power-plant-with-ccs-is-a-positive-step-for-the-climate/

Climate Change Data Science:
https://towardsdatascience.com/https-medium-com-stephaniewillis808-concerning-climate-5a6b923eb8eb

Congressional Research Service: https://fas.org/sgp/crs/misc/R44902.pdf

Global Carbon Capture and Storage: https://co2re.co/FacilityData

Shell: https://www.shell.com/sustainability/sustainability-reporting-and-performance-data/sustainability-reports.html

U.S. Energy Information Association: https://www.eia.gov/environment/emissions/state/

Index: Bayes Classification Scoring

In order to create a classification score, US power plants will be measured amongst a number of critical classifiers as listed below. This scoring system will create both plants that are well qualified for CCS adoption and plants that need improvements before utilizing CCS.

Scoring :   0 - None   1 - Fair   2 - Good   3 - Great

Classifiers:

- Proximity to storage locations (coal seams, oil reserves, etc.,)
- Yearly power generation (GWH)
- Proposed legislation in the state
- Ability to offset costs
- Type of plant (coal, natural gas, oil)

Index - Data size and source

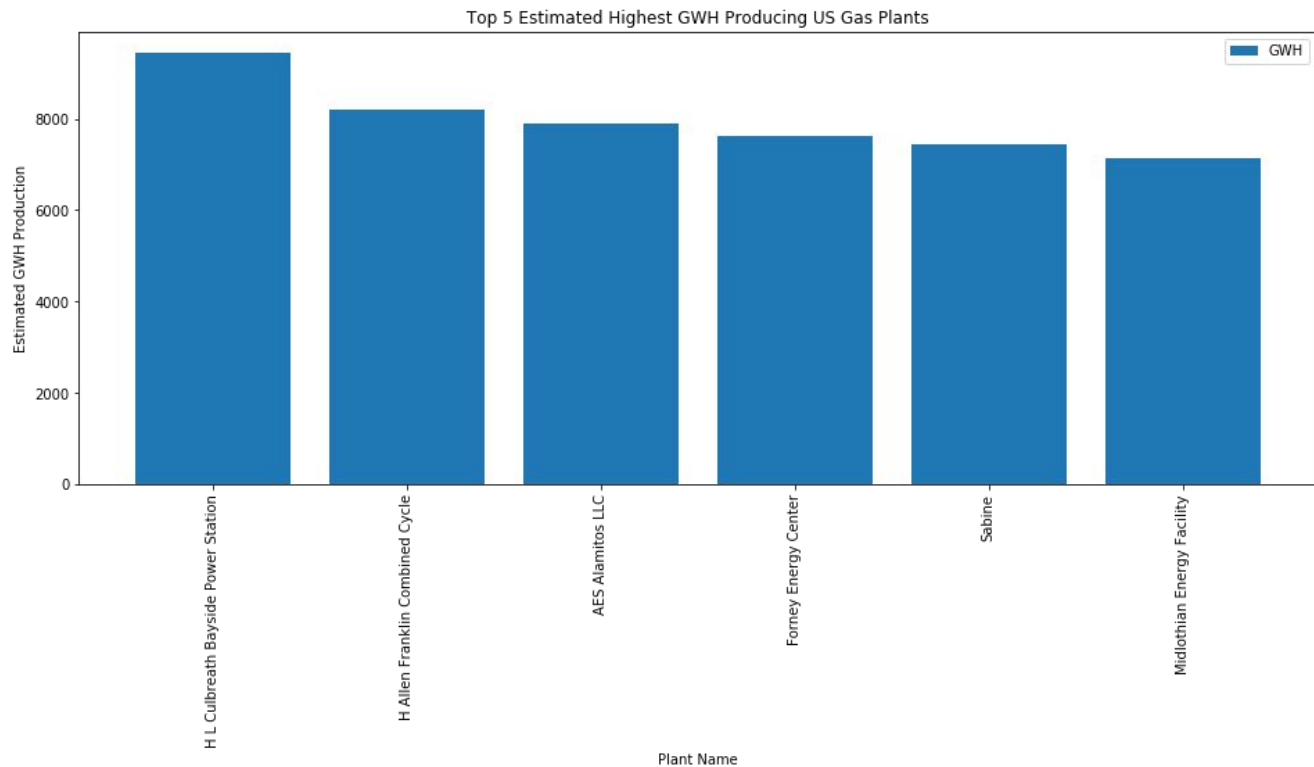http://datasets.wri.org/dataset/globalpowerplantdatabase

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In [4]:   df.shape

Out[4]:   (28664, 22)
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https://www.eia.gov/environment/emissions/state/

```
In [8]:   df_US.shape

Out[8]:   (8119, 22)
```

Index: EDA

Top 5 Estimated Highest GWH Producing US Gas Plants

Index: EDA

Estimated GWH of the Top 3 Producing Plants in Close Proximity to Powder River Basin