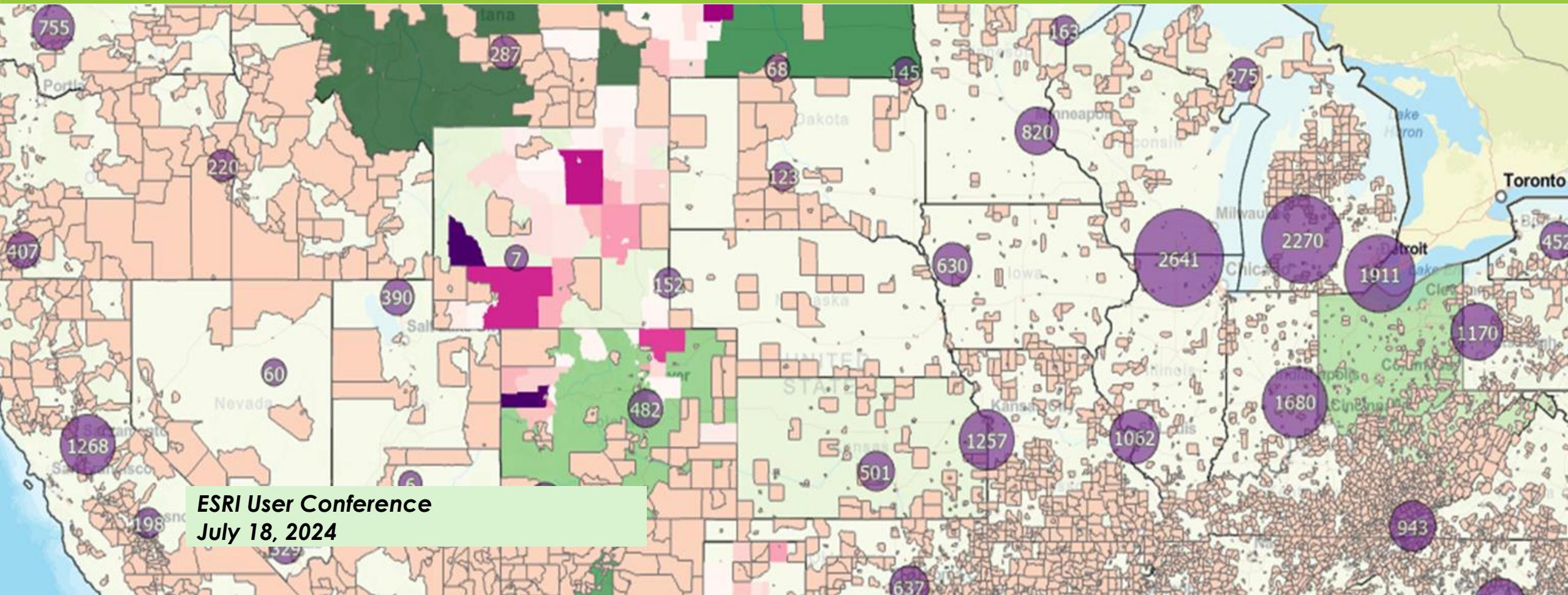


# A Dashboard to Support Just Community Transitions for Carbon Capture and Storage



**Maneesh Sharma**

Geospatial Research Scientist/NETL Support Contractor



ESRI User Conference  
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# Disclaimer

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# Environmental Justice (EJ) and Social Justice (SJ) for Carbon Capture and Storage (CCS) Systems



**Challenge:** Lack of information and insight available to better understand the viability of a CCS project's implementation based off existing EJ and SJ challenges, as well as overall community attitudes toward CCS

**40% of the overall benefits** of certain federal investments—including investments in **clean energy** and **energy efficiency**; clean transit; affordable and sustainable housing; training and workforce development; the remediation and reduction of legacy pollution; and the development of clean water infrastructure—must flow to **disadvantaged communities (Justice40 Initiative (EO 14008, Section 223))**

## Value:

- Provide decision and policy makers EJ-SJ insights on CCS feasibility
- Benefit techno-economic, environmental, and social analyses driving commercial, regulatory, and research supporting the CCS economy

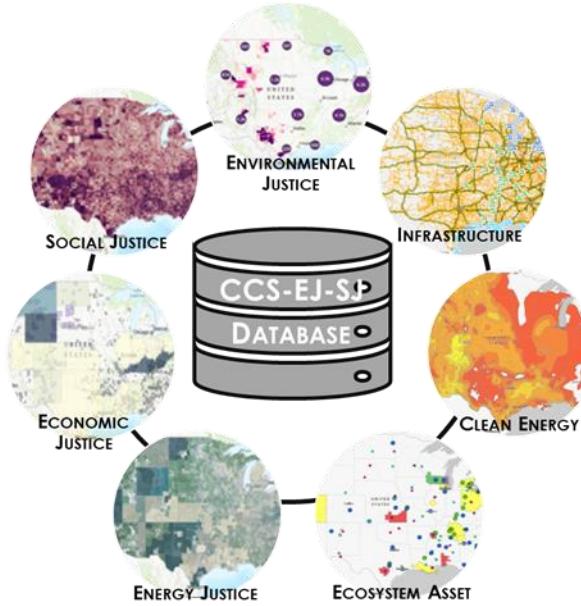
## Objective:

- Identify EJ-SJ factors and resources for supporting assessments and calculating metrics
- Build a nationwide EJ-SJ database to support CCS implementation planning
- Develop an intuitive, interactive dashboard to provide data-driven insights into EJ-SJ opportunities for CCS activities

## Ultimate Product:

- CCS-EJ-SJ database available for download on NETL's Energy Data Exchange (EDX) DisCO<sub>2</sub>ver
- Interactive dashboard designed to support intuitive interaction with CCS-EJ-SJ data to support CCS project efficiency and improve understanding of EJ and SJ factors and how the factors may support or impact commercial, regulatory, and research applications

- CCS-EJ-SJ database showing data organization within major themes
- Available as file geodatabase from EDX



## Data Aggregated from Various Authoritative Sources

Category	Datasets	Sources
Environmental Justice	28	ACS, CDC, EPA, FEMA, NLCD, U.S. Census
Social Justice	38	ACS, CDC, CEQ, EPA, HIFLD, HUD, NASA, U.S. Census
Energy Justice	27	ACS, DOE, EIA, Enverus, EPA, GCCSI, IBRD, NOAA, U.S. Census
Economic Justice	11	ACS, BEA, IWG, NETL, U.S. Census
Clean Energy	9	EIA, HIFLD, NAICS, NREL, ORNL
Ecosystem Assets	12	AMCC, EDA, EPA, DOE, MFG USA, NIST, NSF
Infrastructure	18	EIA, BTS, CEC, FAA, FCC, FRA, HIFLD, MSI, MSHA, NETL, U.S. Census, USDOT, USGS
148 datasets		

# EJ and SJ for CCS Systems



- CCS-EJ-SJ information hosted on EDX
- EDX site includes
  - What's New
  - Data Catalog
  - Database
  - Interactive Online Map

**Data and Resources**

**Download Checked** **Check All**

Filter resources by name...  Search

Date: Newest → Oldest

**What's New-CCS-EJ-SJDatabasev2.0.pdf**  
Creative Commons Attribution  
What's New-CCS-EJ-SJDatabasev2.0 has description of each layer in the database along with citation and reference information.

**CCS-EJ-SJv2.0dataCatalog.xlsx**  
No License Restrictions  
Detailed data catalog for CCS-EJ-SJ v2.0 database. The CCS-EJ-SJ database integrates datasets from various federal agencies and authoritative sources to aid stakeholders and decision makers of the social and environmental factors that might impact the viability of CCS and energy related project implementation. There are 7 categories in the CCS EJSJ v2 database: environmental justice, energy assets, clean energy, and infrastructure.

**CCS-EJ-SJ online map**  
No License Restrictions  
Webmap for the CCS-EJ-SJ (Carbon Capture and Storage - Environmental Justice - Social Justice) database v2.0 visualizes the integrated datasets from various federal agencies and authoritative sources to aid stakeholders and decision makers of the social and environmental factors that might impact the viability of CCS injection project implementation such as community attitudes, perceptions, transportation rights of way, and more. There are 7 categories in the CCS EJSJ v2.0 database and web map: environmental justice, energy justice, economic justice, social justice, energy assets, clean energy, and infrastructure. This is an evolving project and the application will be updated periodically with new datasets and information.

**CCS-EJ-SJDatabase\_v2\_gdb.zip**  
No License Restrictions  
The CCS-EJ-SJ database integrates datasets from various federal agencies and authoritative sources to aid stakeholders and decision makers of the social and environmental factors that might impact the viability of CCS injection project implementation. There are 7 categories in the CCS EJSJ v2 database: environmental justice, energy justice, economic justice, social justice, energy assets, clean energy, and infrastructure.

**CCS-EJ-SJ Interactive Map Alpha**

Layers

- Environmental Justice
- Energy Justice
- Social Justice
- Infrastructure
- Ecosystem Assets
- Economic Justice
- Clean Energy

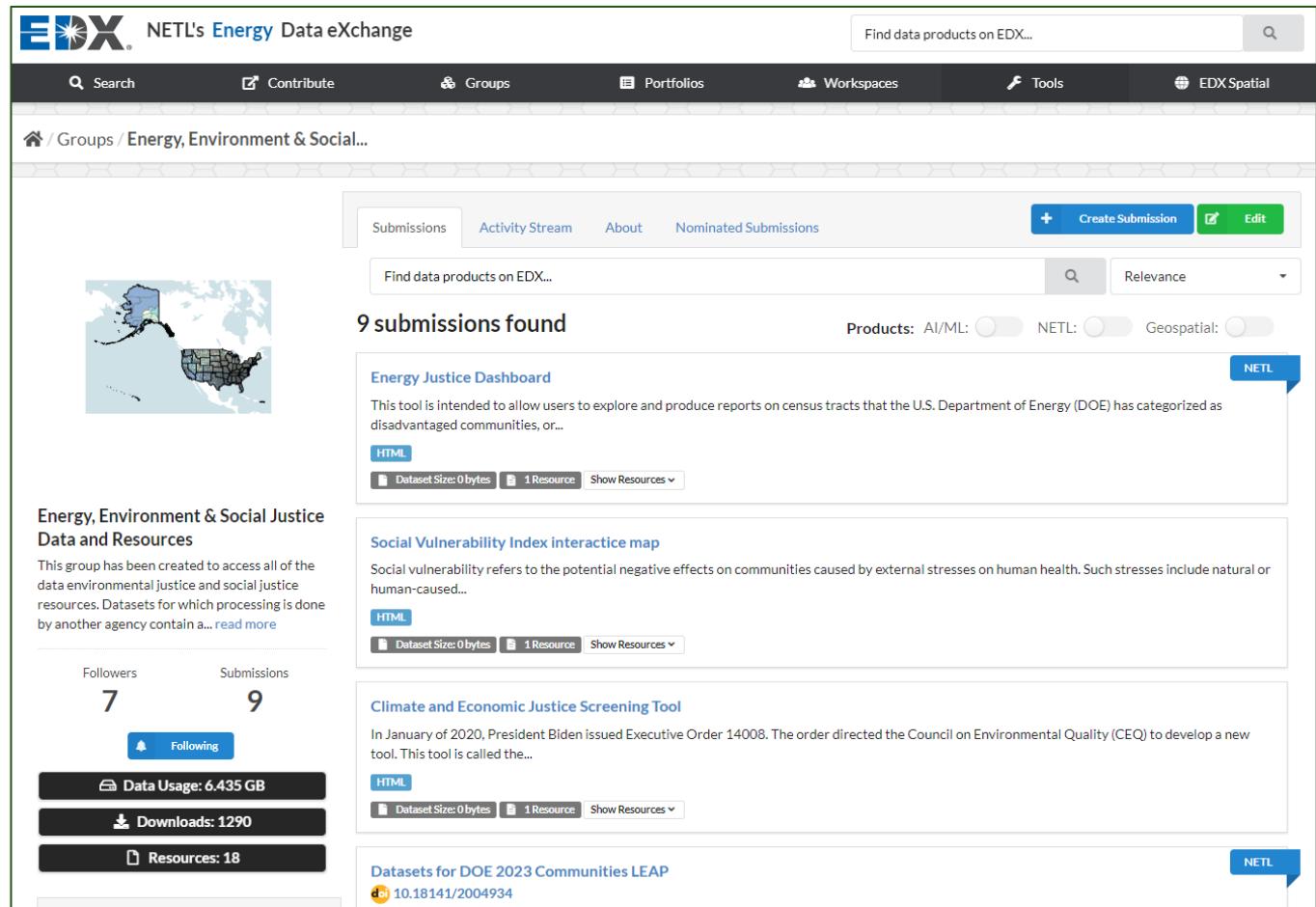
**Types of EJ-SJ information and metrics available in version 2 of the CCS-EJ-SJ Database (Sharma et al., 2024; <https://edx.netl.doe.gov/dataset/ccs-ej-sj-database>)**

**Interactive Online Map**



A web-hosted, virtual library and laboratory that supports the public and the NETL community

Central location for EJ-SJ related information [Energy, Environment & Social Justice Data and Resources](#)  
- Groups - [EDX \(doe.gov\)](#)



EDX NETL's Energy Data eXchange

Groups / Energy, Environment & Social...

Submissions Activity Stream About Nominated Submissions

+ Create Submission Edit

Find data products on EDX...

Relevance

9 submissions found

Products: AI/ML:  NETL:  Geospatial:

**Energy Justice Dashboard**  
This tool is intended to allow users to explore and produce reports on census tracts that the U.S. Department of Energy (DOE) has categorized as disadvantaged communities, or...

**Social Vulnerability Index interactive map**  
Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused...

**Climate and Economic Justice Screening Tool**  
In January of 2020, President Biden issued Executive Order 14008. The order directed the Council on Environmental Quality (CEQ) to develop a new tool. This tool is called the...

**Datasets for DOE 2023 Communities LEAP**  
DOI 10.18141/2004934

NETL



# Community Attitude Toward CCS



## Purpose

This analysis aims to capture sentiment toward topics in CCS using text data extracted from news articles, community forums, and social platforms.

### 1. Spatial Patterns

- How does sentiment toward CCS vary by geography, and what regional differences can be identified?

### 2. Word Association

- What topics, terms, and phrases are primary drivers of sentiment scores, and how do they influence public perception?

### 3. Public Concerns and Support

- What are the main concerns and areas of support among communities regarding CCS projects?

### 4. Media Influence

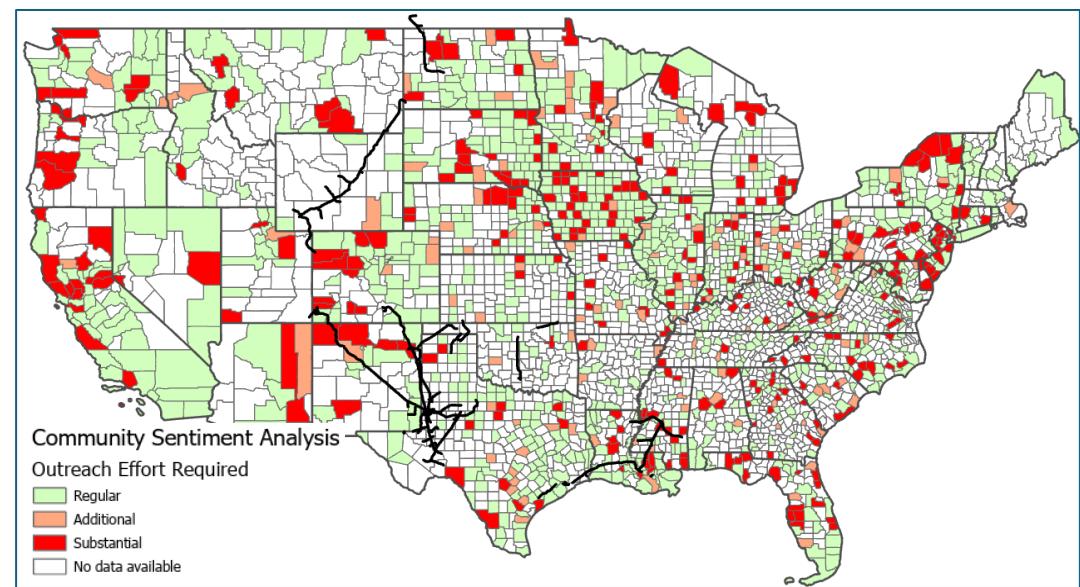
- How does media coverage affect sentiment and public discourse on CCS?

### 5. Future Trends

- What emerging trends can be identified in public sentiment towards CCS?

# Community Attitude Toward CCS

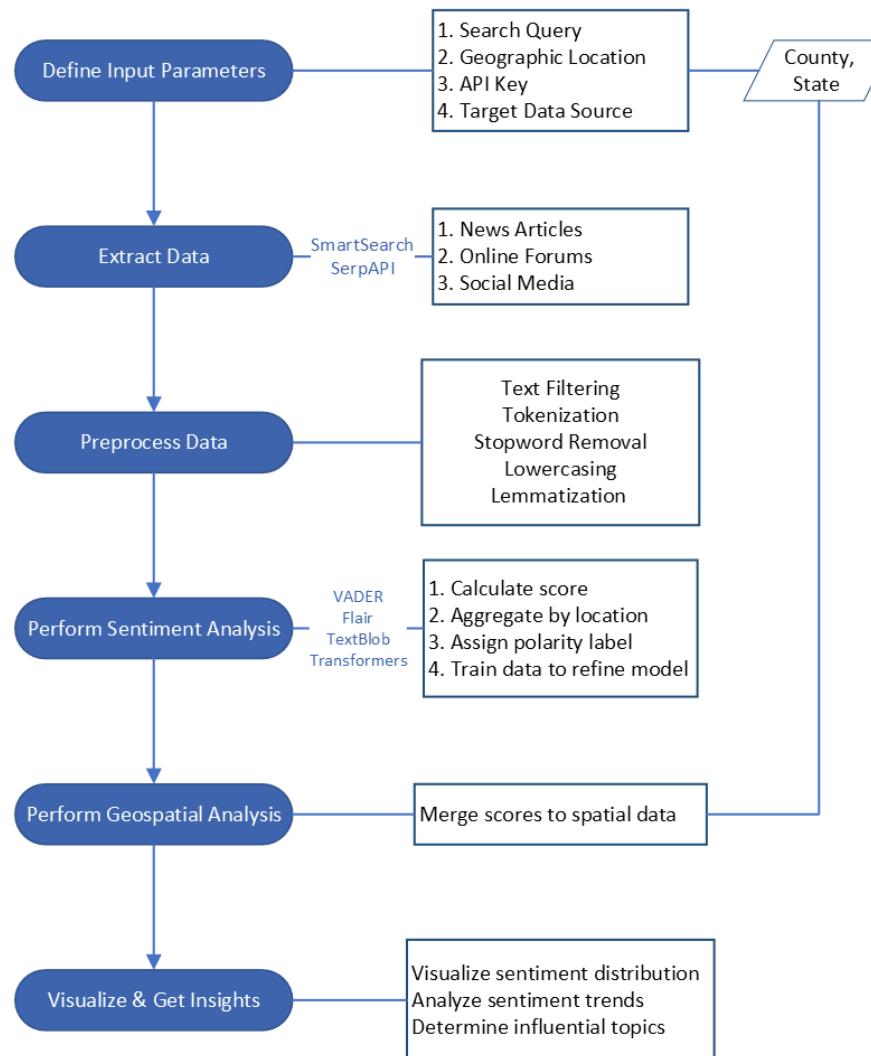
- Developed a community sentiment model to help characterize community sentiment toward CCS based off public media resources and notes from legislative meetings.
  - Applied machine learning, online, search tool to identify community attitudes toward CCS, including the use of NETL SmartSearch and other Search Engine APIs.



Example of the output from the community sentiment analysis, designed to review public comments made, and provide a recommended level of outreach engagement needed for planned or proposed CCS activities.

# Community Attitude Toward CCS

## Workflow



# CCS-EJ-SJ Interactive Web Application

## Welcome/Informational Screen



- CCS-EJ-SJ web application is being built using the developer's version of ESRI's Experience Builder
- Goal is to provide the stakeholder a central place for authoritative data
- Users/stakeholders can interact with data and print a custom report

The screenshot shows the 'Carbon Capture and Storage Environmental Justice - Social Justice (EJ/SJ)' application. The map displays several data layers, including Environmental Justice, Energy Justice, Social Justice, Infrastructure, Ecosystem Assets, Economic Justice, and Clean Energy. A modal window in the center provides a detailed description of the CCS-EJ-SJ database and its purpose. The modal includes the U.S. Department of Energy and NETL logos, a 'Don't show this again' checkbox, and an 'OK' button. The map also features a legend for Social Justice and Population, and an 'ADD YOUR DATA' section. The right side of the screen contains an 'ABOUT THE FEATURES' section with detailed descriptions of each data layer, and a 'CEJST DISADVANTAGED COMMUNITIES MAP' section at the bottom right.

**Carbon Capture and Storage Environmental Justice - Social Justice (EJ/SJ)**

The CCS-EJ-SJ (Carbon Capture and Storage - Environmental Justice - Social Justice) database and web map contains integrated datasets from various federal agencies and authoritative sources to help inform users and decision makers of the social and environmental factors that might impact the viability of CCS injection project implementation such as community attitudes, pore space rights, disadvantaged communities, protected lands, transportation rights of way, and more. This is an evolving project and the application will be updated periodically with new datasets and information.

**Environmental Justice**

This feature dataset contains environmental justice data such as brownfields, Center for Disease Control and Prevention (CDC) Environmental Justice Index ranks, the Environmental Protection Agency (EPA) Environmental Justice Index by census tract and block group, land cover, and the Federal Emergency Management Agency (FEMA) National Risk Index by census tract as feature classes.

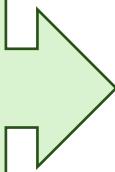
**CEJST DISADVANTAGED COMMUNITIES MAP**

# CCS-EJ-SJ Interactive Web Application



## Main Application

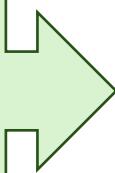
Map Layers and General Search



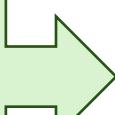
The screenshot shows the main interface of the CCS-EJ-SJ Interactive Web Application. At the top, there is a header with the U.S. Department of Energy logo and the title "Carbon Capture and Storage Environmental Justice - Social Justice (EJ/SJ)". The left side features a "MAP LAYERS and SEARCH" panel with checkboxes for categories like Environmental Justice, Energy Justice, Social Justice, Infrastructure, Ecosystem Assets, Economic Justice, and Clean Energy. Below this is a "LEGEND" section with a "Social Justice" map and a "Population" map. The main area is a map of the United States with various data layers visible. A callout box labeled "Attribute Tables" points to a table at the bottom left showing demographic data for different age groups. The right side of the interface has a "Tools" panel with various icons and a "ABOUT THE FEATURES" section with detailed information about the data layers. A "CEJST DISADVANTAGED COMMUNITIES MAP" is also visible on the right.

Percent Total Population 35 to 44 Years	Percent Total Population 45 to 54 Years	Percent Total Population 55 to 59 Years	Percent Total Population 60 to 64 Years	Percent Total Population 65 to 74 Years
13.1	7.7	11.5	16.3	
11.7	7.2	8.9	11.5	
8	7.4	12.4	8.3	6.3

Map Legend of Active Layers



Add Your Own Data!



Tools



ABOUT THE FEATURES

The CCS-EJ-SJ database integrates datasets from various federal agencies and authoritative sources to aid stakeholders and decision makers of the social and environmental factors that might impact the viability of CCS and energy related project implementation. There are 7 categories in the CCS EJSJ v2 database: environmental justice, energy justice, economic justice, social justice, ecosystem assets, clean energy, and infrastructure. Most of the layers within each category have been updated in this version. Layers that have not been updated have been marked with an asterisk (\*). As compared to the old database, there are 3 new categories in the v2 database: ecosystem assets, clean energy and infrastructure. Below is the description each data layer within each category:

**Environmental Justice**

This feature dataset contains environmental justice data such as brownfields, Centers for Disease Control and Prevention (CDC) Environmental Justice Index ranks, the Environmental Protection Agency (EPA) Environmental Justice Index by census tract and block group, land cover, and the Federal Emergency Management Agency (FEMA) National Risk Index by census tract as feature classes.

Right Column Info (pulls dynamically from layers)



U.S. DEPARTMENT OF  
ENERGY

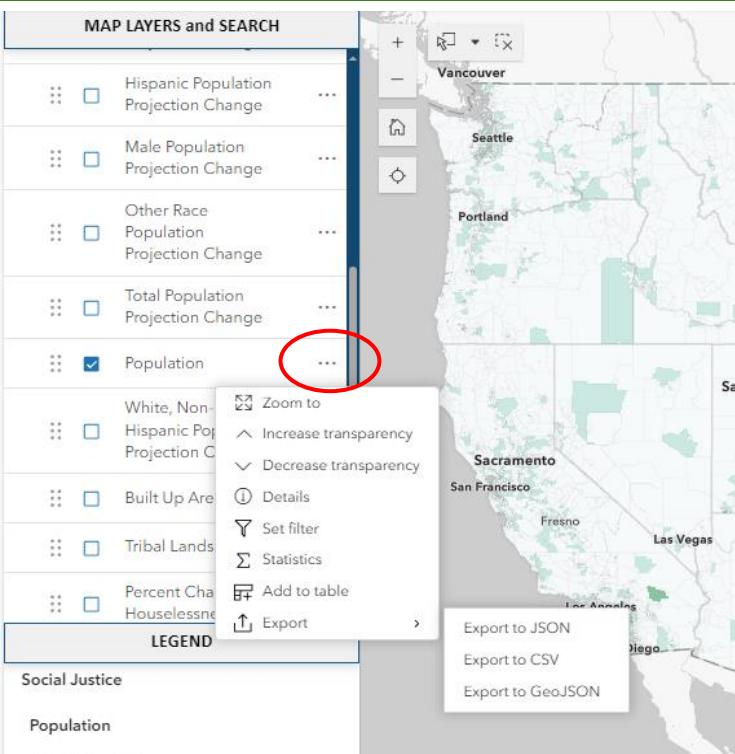
# CCS-EJ-SJ Interactive Web Application



## Layers: Associated Tools

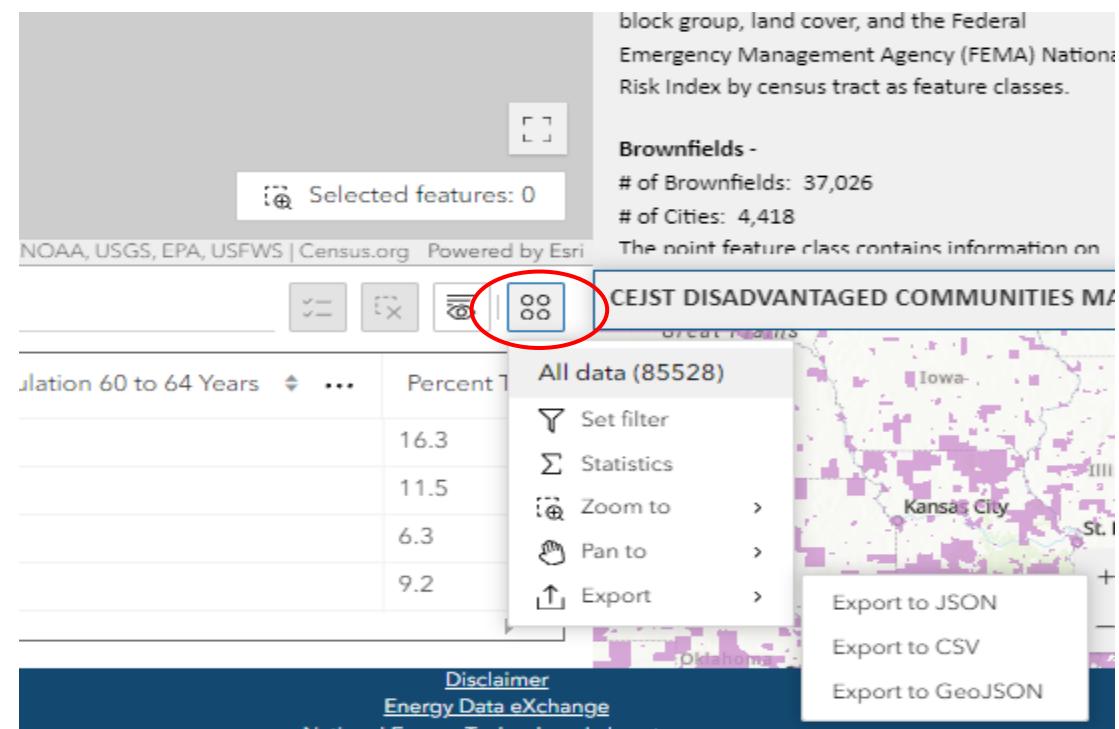
### Get from Map Layers:

Click on the icon (circled) to access tools via Map Layers: Zooming, Transparency, Layer Details, Filter Data, Generate Statistics, View Attribute Data in Attribute Table, Export Data (as JSON, CSV, GeoJSON; geospatial files planned for Ver. 2)



### Get from Attribute Table:

Click on the icon (circled) to access tools via the Attribute Table: Filter Data, Generate Statistics, Zooming, Pan to Data in the Map, Export Data (as JSON, CSV, GeoJSON; geospatial files (upcoming))



# CCS-EJ-SJ Interactive Web Application



## Grouped Layers: Environmental and Energy Justice

The screenshot shows a web application interface for managing map layers. At the top is a search bar with a magnifying glass icon. Below it is a list of grouped map layers. The first group, 'Environmental Justice', is expanded, showing:

- Environmental Justice
- Brownfields
- CDC Environmental Justice Index Ranks
- EPA Environmental Justice Screen Blockgroup
- EPA Environmental Justice Screen Tracts
- National Risk Index
- Land Cover

The second group, 'Energy Justice', is also expanded, showing:

- Energy Justice
- Social Justice
- Infrastructure
- Ecosystem Assets
- Economic Justice
- Clean Energy

The third group, 'Environmental and Energy Justice', is collapsed, showing:

- Environmental and Energy Justice

Red arrows point from the collapsed 'Environmental and Energy Justice' layer to the expanded 'Environmental Justice' and 'Energy Justice' layers, indicating that they are grouped together.



## Tools: The Toolbar

More tools are planned for Version 2.



Choose your own base (background) map.



Bookmark your areas of interest and return to them (in a viewing session).



Query layers (in development).



Spatially select layers (in development).



Draw and Measure Tool. Place a point, draw lines, draw polygons. Turn on measure to get a point location, length of a line, square miles within a polygon



Analysis Tool. (Further development. This tool will be incorporated into other tools.)



Standard Print Tool. In version 2, this will be replaced with a customized print and report tool.



Sharing Tool. Share the map via social media or email.



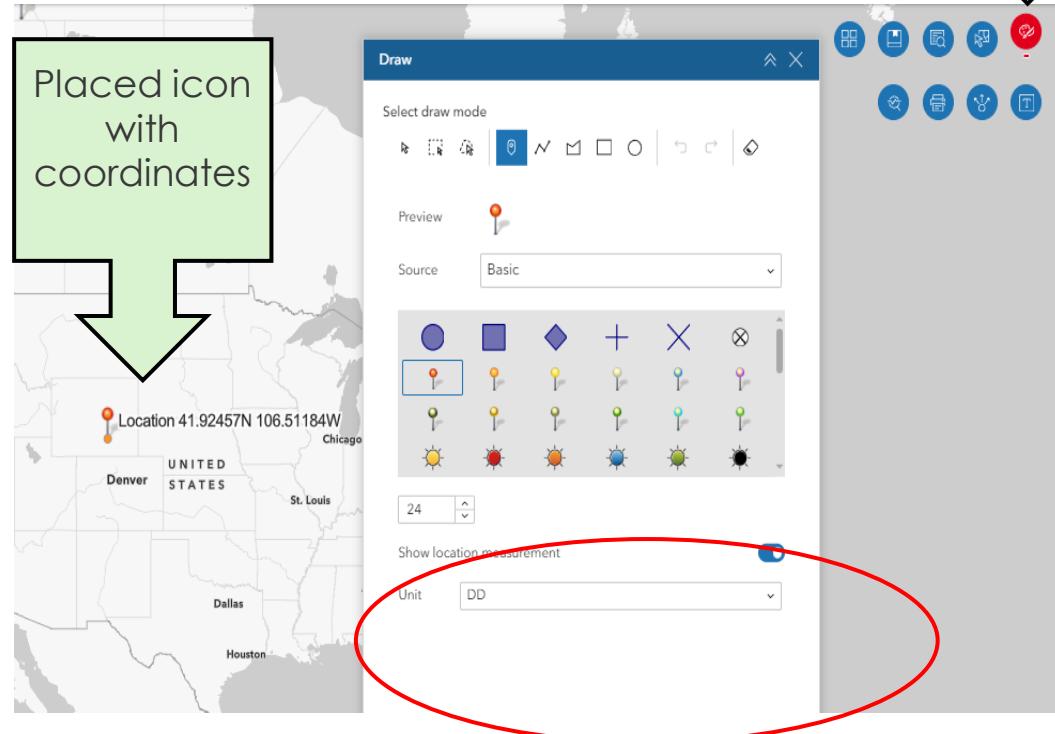
Informational Tool. General information on the map application itself. This tool is in development.

# CCS-EJ-SJ Interactive Web Application

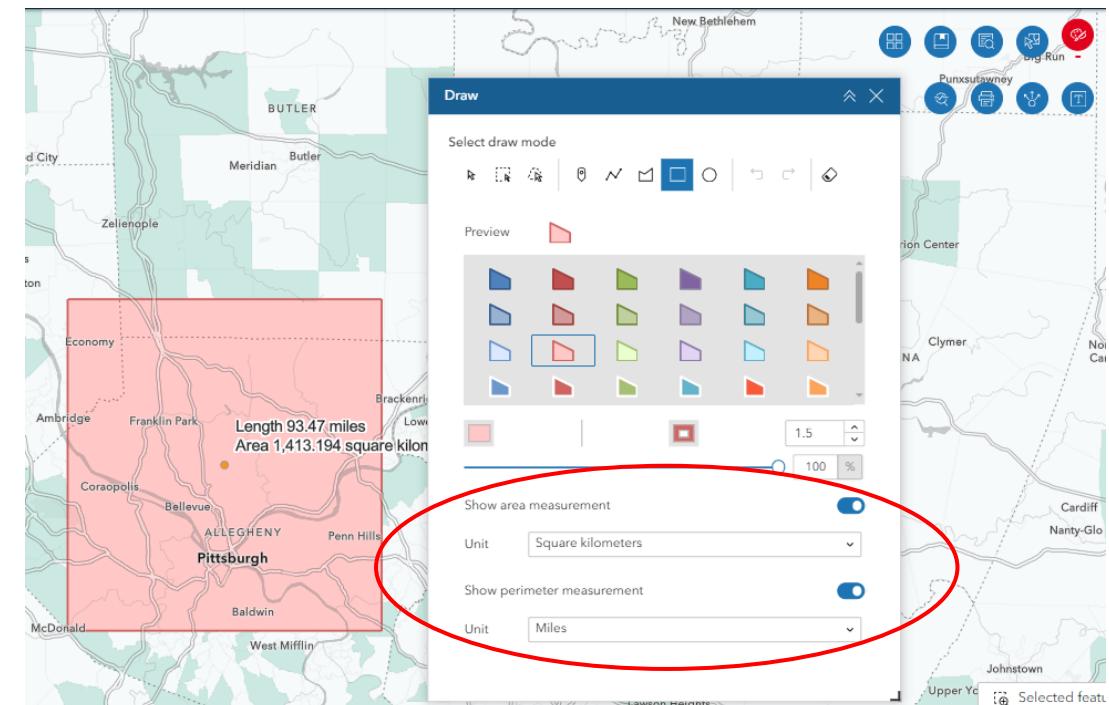


## Tool Example: The Draw and Measure Tool

The Draw and Measure Tool for a point with "Show location measurement" turned on.



The Draw and Measure Tool for a polygon with "Show location measurement" turned on for both area measurement and perimeter measurement.



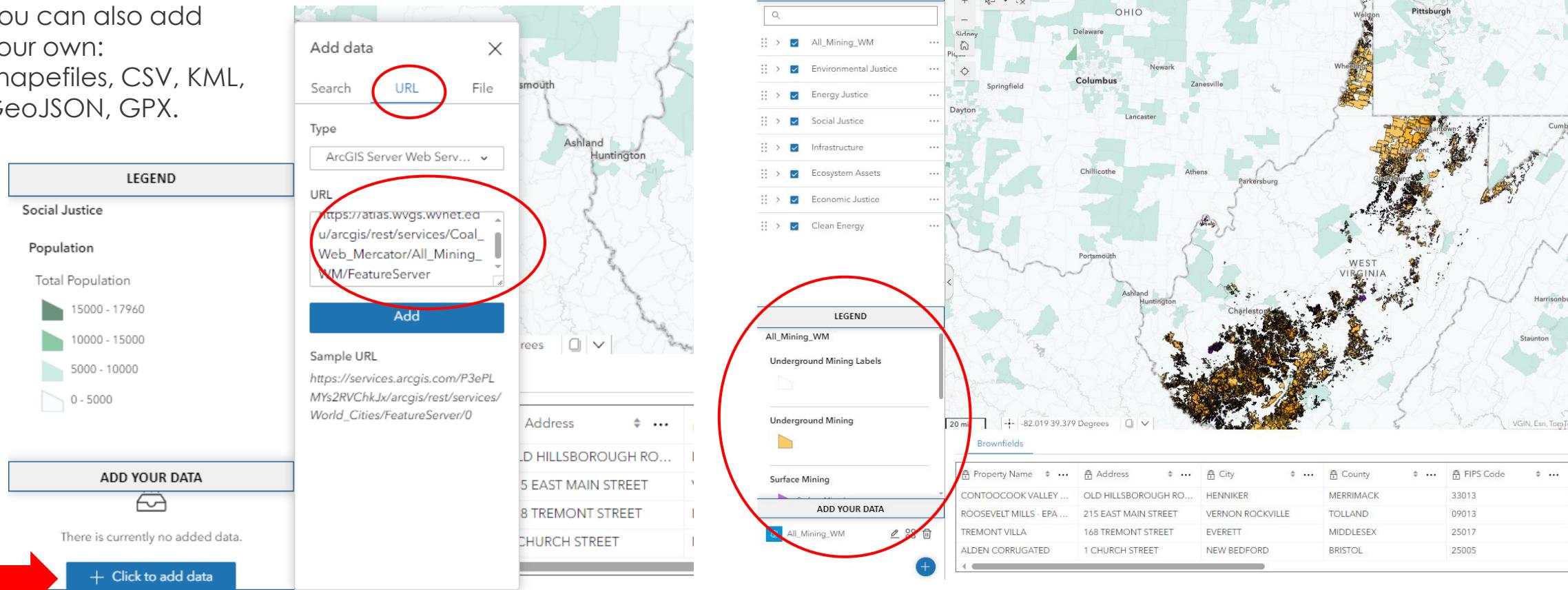
# CCS-EJ-SJ Interactive Web Application



## Tool Example: The Add Data Tool

Example of using an exterior web service (REST). Below, an "All Mining" layer is added from the West Virginia Geological and Economic Survey. [https://atlas.wvgs.wvnet.edu/arcgis/rest/services/Coal\\_Web\\_Mercator/All\\_Mining\\_WM/FeatureServer](https://atlas.wvgs.wvnet.edu/arcgis/rest/services/Coal_Web_Mercator/All_Mining_WM/FeatureServer)

You can also add  
your own:  
Shapefiles, CSV, KML,  
GeoJSON, GPX.



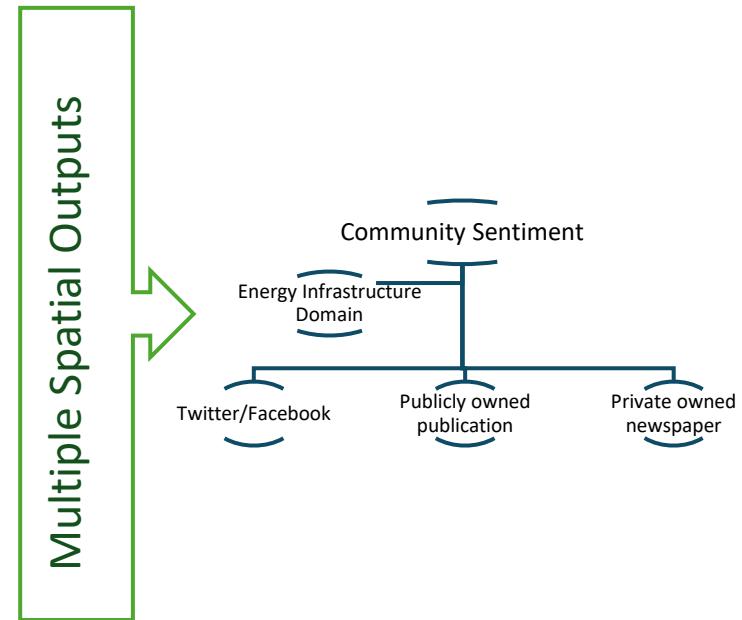
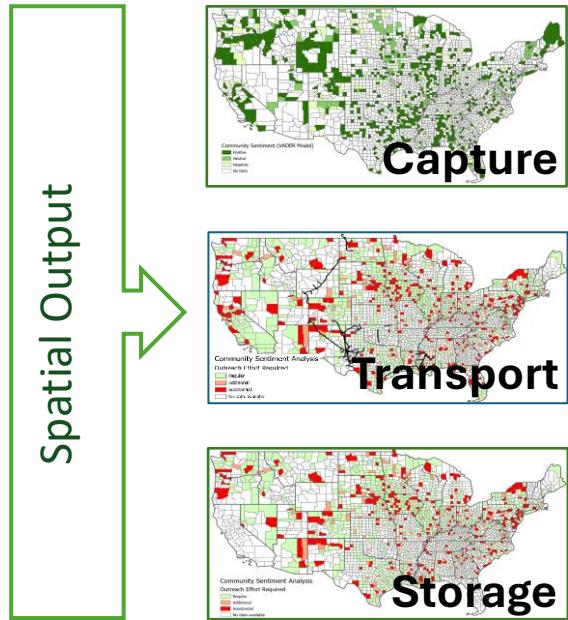
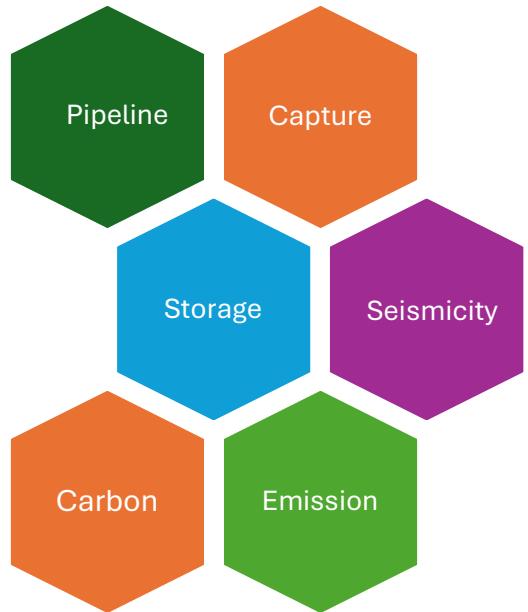
The screenshot illustrates the process of adding an "All Mining" layer from the West Virginia Geological and Economic Survey using the ArcGIS Add Data tool. The interface is divided into several sections:

- Left Panel (Legend):** Shows population density categories: 0 - 5000 (light yellow), 5000 - 10000 (light green), 10000 - 15000 (medium green), and 15000 - 17960 (dark green).
- Top Left (Add Data Dialog):** A modal window titled "Add data" with tabs for "Search" and "URL". The "URL" tab is selected and highlighted with a red circle. The URL input field contains the REST service URL: [https://atlas.wvgs.wvnet.edu/arcgis/rest/services/Coal\\_Web\\_Mercator/All\\_Mining\\_WM/FeatureServer](https://atlas.wvgs.wvnet.edu/arcgis/rest/services/Coal_Web_Mercator/All_Mining_WM/FeatureServer). A red circle highlights this URL field.
- Bottom Left (ADD YOUR DATA):** A section with a red arrow pointing to a button labeled "+ Click to add data".
- Center (Map and Table):** The main workspace shows a map of the Ohio and West Virginia region with numerous mining activity points. A legend on the left identifies the symbols: "All\_Mining\_WM" (yellow square), "Underground Mining Labels" (yellow diamond), "Underground Mining" (yellow square), and "Surface Mining" (purple square). A red circle highlights the "All\_Mining\_WM" entry in the legend. Below the map is a table titled "Brownfields" listing properties:

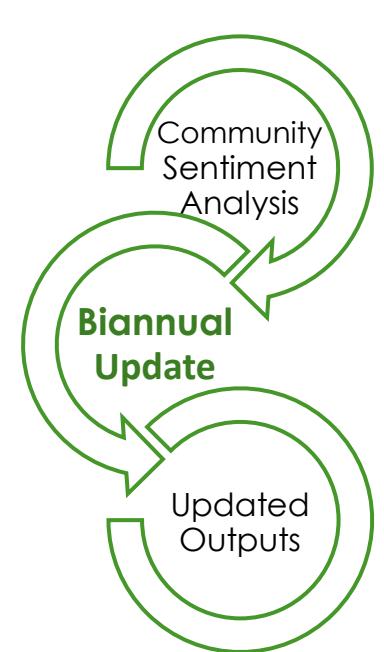
Property Name	Address	City	County	FIPS Code
CONTOOCOOK VALLEY ...	OLD HILLSBOROUGH RO...	HENNIKER	MERRIMACK	33013
ROOSEVELT MILLS - EPA ...	215 EAST MAIN STREET	VERNON ROCKVILLE	TOLLAND	09013
TREMONT VILLA	168 TREMONT STREET	EVERETT	MIDDLESEX	25017
ALDEN CORRUGATED	1 CHURCH STREET	NEW BEDFORD	BRISTOL	25005



## Community Sentiment on Energy Infrastructure



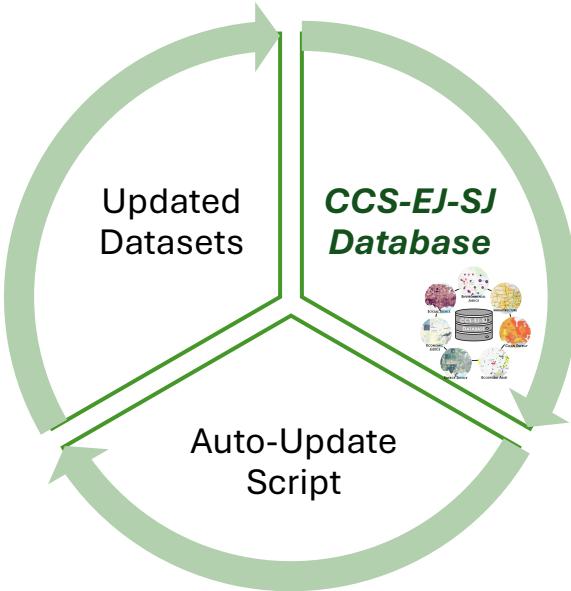
## Update Frequency



# CCS-EJ-SJ Coming Updates

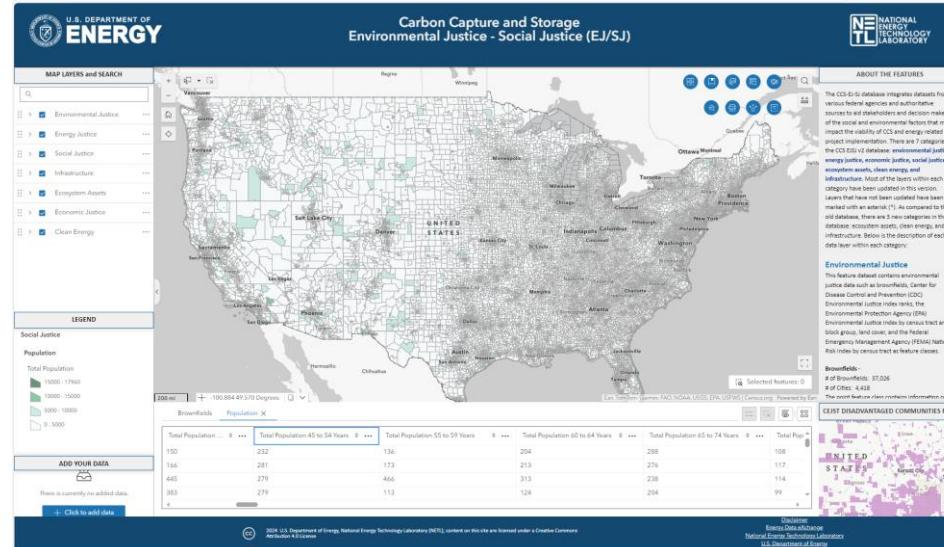


## Script- Auto Update Database



Auto-Update Script  
for various data sources.

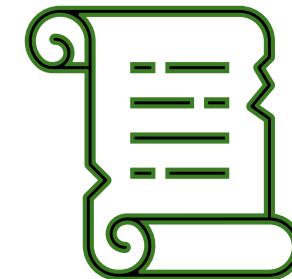
## Web Application



Create Dashboard - Advanced functionality;  
including support for advanced data queries  
and output of stylized reports.

<https://edx.netl.doe.gov/dataset/ccs-ej-sj-database>

## Manuscript



Draft manuscript-  
community sentiment  
analysis models, model  
outputs and results.



Integrate data and dashboard  
into EDX DisCO<sub>2</sub>ver Platform for  
user access.

# Acknowledgments

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# NETL RESOURCES

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