

CS PlanIT (Carbon Storage Planning Inquiry Tool)



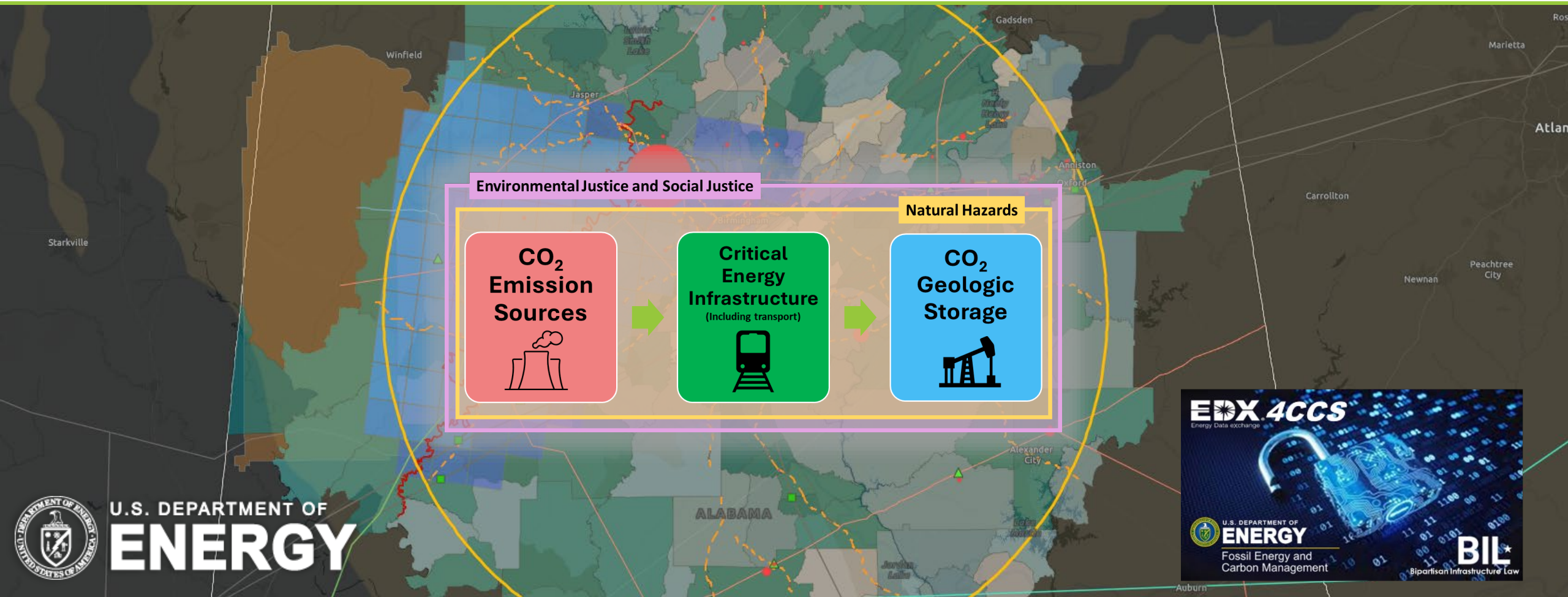
Providing Data and Insights for Accelerating Carbon Transport & Storage Deployment

Devin Justman

Geology/Geospatial Research Scientist/NETL Support Contractor

2024 FECM/NETL Carbon Management Research Project Review Meeting

Aug. 6, 2024



Disclaimer



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Authors and Contact Information



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⁵NETL Support Contractor, 3610 Collins Ferry Road, Morgantown, WV 26505, USA

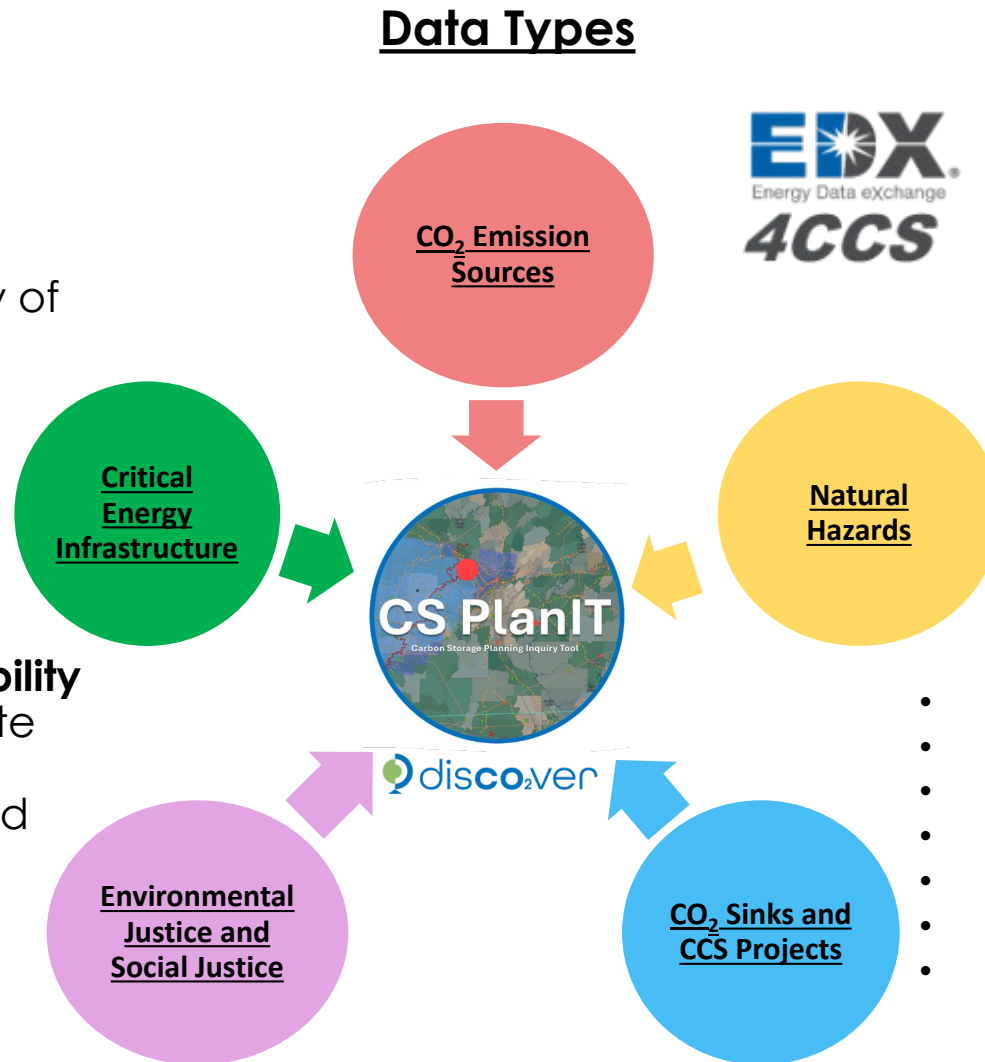


Problem:

- CS Planning requires the consideration of multiple factors linked to a variety of disparate, multi-sourced datasets that require integration

Purpose:

- Improve data discoverability** to support and accelerate carbon storage resource feasibility assessments and planning efforts.



User community:

- Potential stakeholders include well/plant operators, policy makers, researchers, public communities

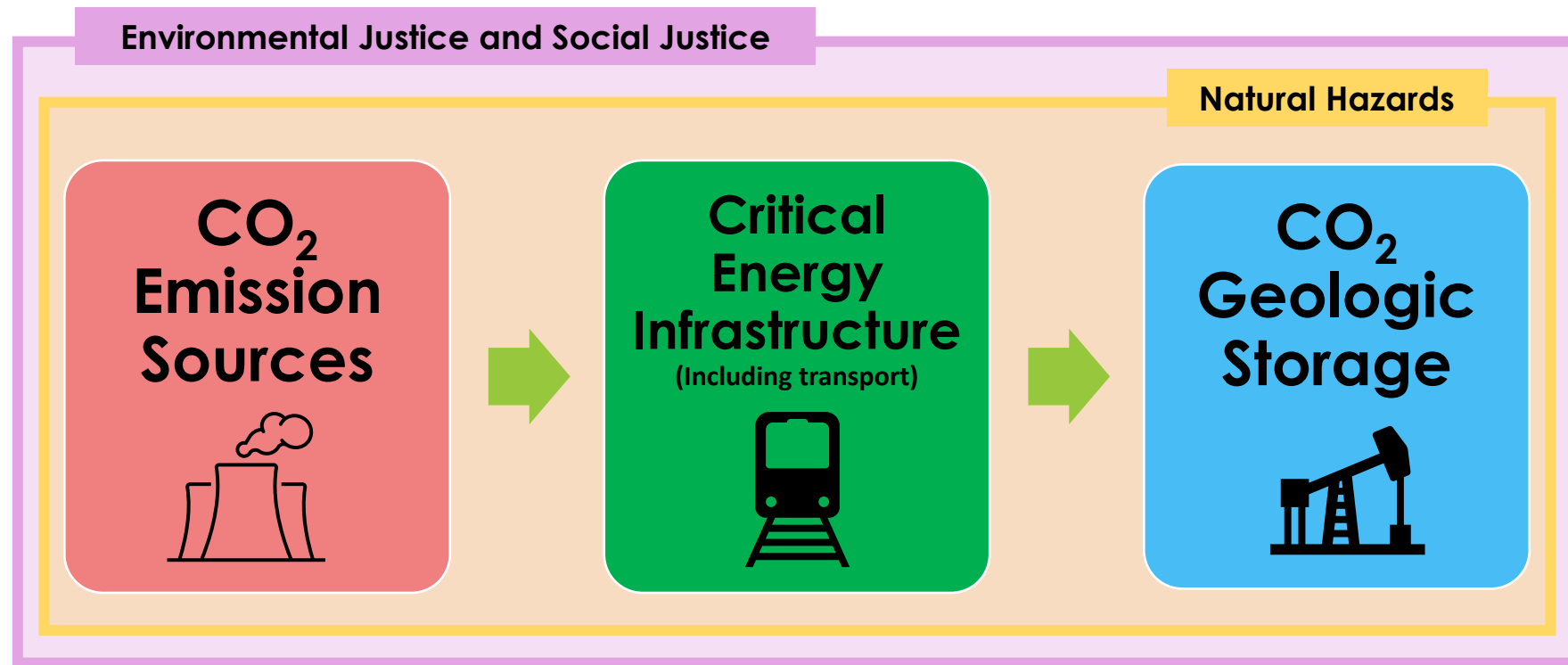
Potential insights for a given area...

- What are the population/community impacts?
- What are the potential natural hazards?
- What are the CO₂ emissions sources and amounts?
- Are there candidate infrastructure for reuse?
- Are there potential CO₂ reservoirs?
- What are current storage estimates?
- What are the current carbon storage projects?

Carbon Storage Planning Inquiry Tool (CS PlanIT) v1.0

Approach

- Identify and integrate spatial datasets most relevant for CS planning efforts
 - Publicly available data from authoritative sources and other EDX4CCS projects
- Build a tool to **enhance data discovery** for a **user-defined** geographic area of interest...
- To better **find, explore, understand** relevant dataset across the CS value chain



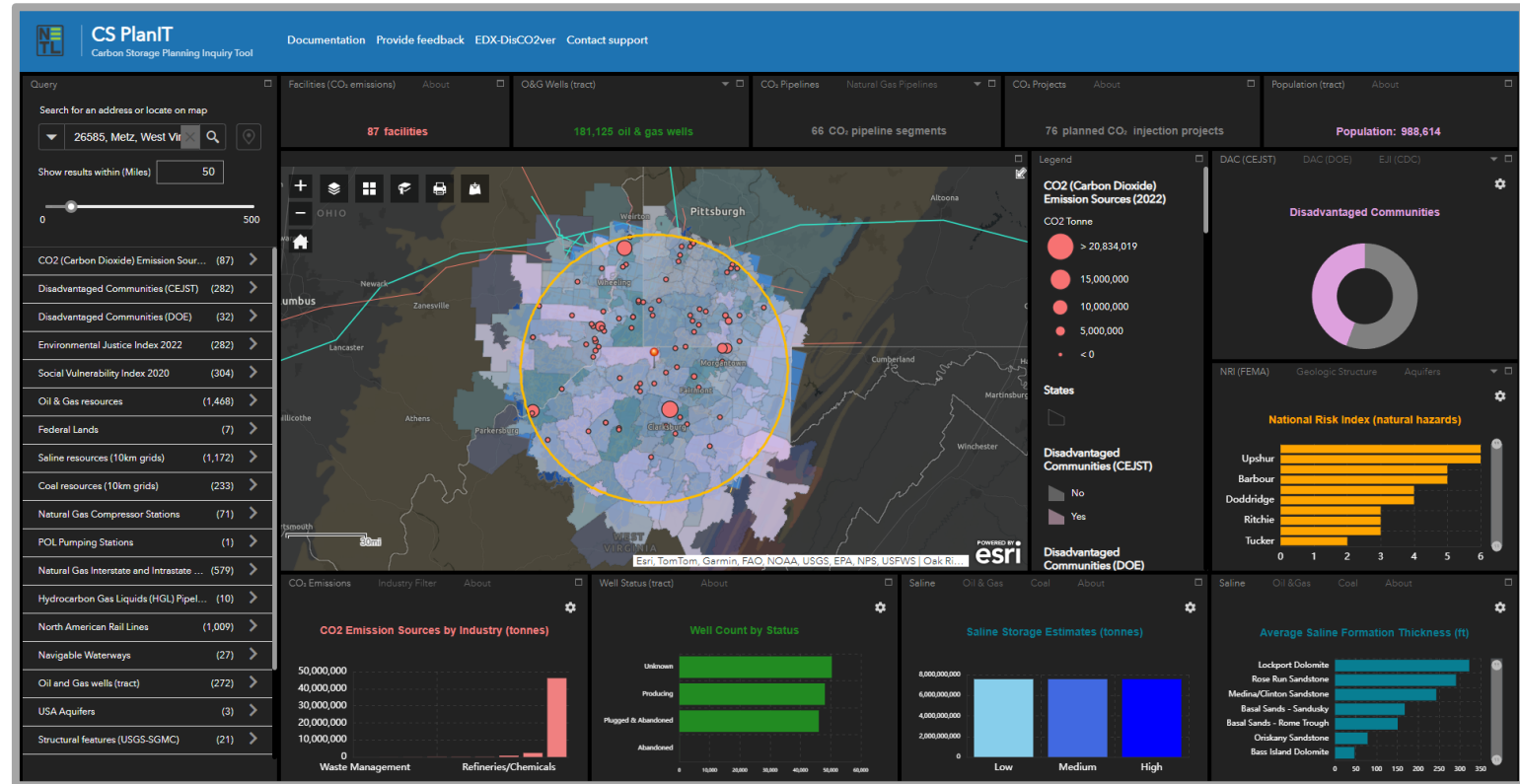
Carbon Storage Planning Inquiry Tool (CS PlanIT) v1.0



Accomplishments to date

- Identified, cataloged, integrated **thousands of features & hundreds of attributes** across the EDX4CCS & CS data portfolios
- Organized data/stats into key categories:
 - Carbon dioxide (CO₂) emission sources
 - Critical energy infrastructure
 - CO₂ sinks/CCS (Carbon Capture & Storage) projects
 - Natural hazards
 - Environmental & Social Justice
- Successfully developed and tested the **Alpha and Beta versions** (Year 1 and 2, respectively) of CS PlanIT
- Public release of CS PlanIT** on the EDX (Energy Data eXchange) by **6/30/2024**

CS PlanIT v1.0



Example spatial data query within CS PlanIT, yellow circle on map represents user defined area of interest.

<https://edx.netl.doe.gov/dataset/cs-planit-carbon-storage-planning-inquiry-tool>

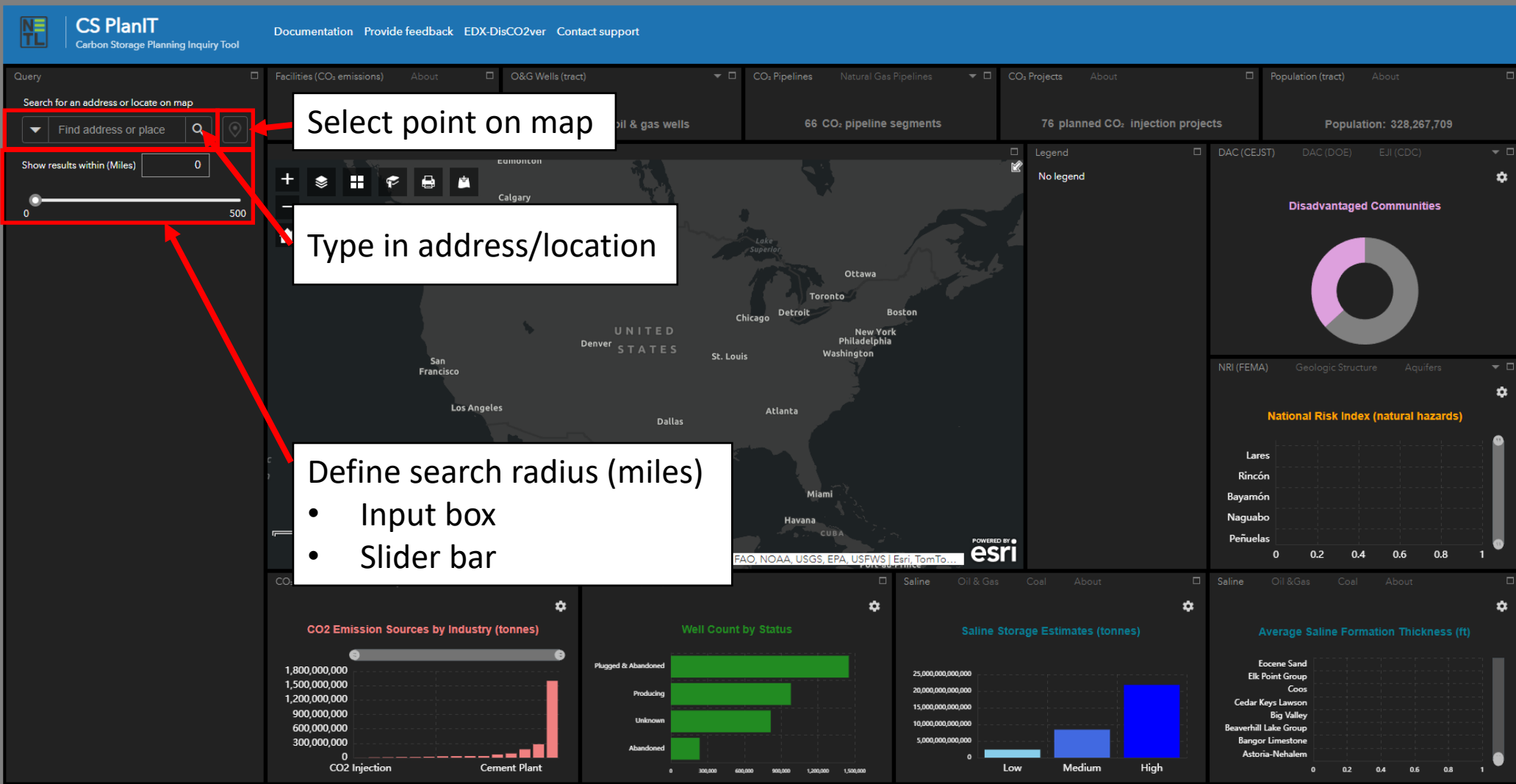
Carbon Storage Planning Inquiry Tool (CS PlanIT) v1.0

General layout

- Data querying/filtering
- Map and legend
- Charts and statistics (categories by color)
- External links



Find Your Area of Interest



The screenshot shows the CS PlanIT Carbon Storage Planning Inquiry Tool interface. The top navigation bar includes the NE TL logo, the title 'CS PlanIT Carbon Storage Planning Inquiry Tool', and links for 'Documentation', 'Provide feedback', 'EDX-DisCO2ver', and 'Contact support'. Below the navigation bar, there are several panels for data visualization and search. The search panel on the left has a search bar with the text 'Find address or place' and a magnifying glass icon. Below the search bar is a slider for 'Show results within (Miles)' ranging from 0 to 500. The main map area shows a map of the United States with various cities labeled. The right side of the interface features several data panels, including 'Disadvantaged Communities' with a donut chart, 'National Risk Index (natural hazards)' with a grid, and 'CO2 Emission Sources by Industry (tonnes)' with a bar chart. The bottom of the interface shows four more data panels: 'Well Count by Status' with a horizontal bar chart, 'Saline Storage Estimates (tonnes)' with a bar chart, and 'Average Saline Formation Thickness (ft)' with a grid.

Select point on map

Type in address/location

Define search radius (miles)

- Input box
- Slider bar

Explore Your Area of Interest

CS PlanIT
Carbon Storage Planning Inquiry Tool

Documentation Provide feedback EDX-DisCO2ver Contact support

Query: Search for an address or locate on map
87420, Shiprock, New Mexico
Show results within (Miles): 40

14 facilities 35,955 oil & gas wells 1 CO₂ pipeline segments 1 planned CO₂ injection projects Population: 157,904

Area of Interest

List of datasets filtered by AOI

- EPA Class VI permits as of 04 2024 (1)
- CO₂ (Carbon Dioxide) Emission Sour... (14)
- Disadvantaged Communities (CEJST) (40)
- Disadvantaged Communities (DOE) (14)
- Environmental Justice Index 2022 (40)
- Social Vulnerability Index 2020 (43)
- Tribal Census Tracts (14)
- Oil & Gas resources (143)
- Federal Lands (29)
- Saline resources (10km grids) (455)
- Coal resources (10km grids) (109)
- Carbon Dioxide Pipelines (1)
- Natural Gas Compressor Stations (6)
- POL Pumping Stations (3)
- Natural Gas Interstate and Intrastate P... (35)
- Crude Oil Trunk Pipelines (2)
- Petroleum Products Pipelines (1)
- Hydrocarbon Gas Liquids (HGL) Pipeli... (1)

CO₂ Emission Sources by Industry (tonnes)

Industry	CO ₂ Emissions (tonnes)
Waste Management	~1,000,000
Electricity Generation	~12,000,000

Well Count by Status

Status	Count
Producing	~15,000
Plugged & Abandoned	~8,000
Unknown	~4,000
Abandoned	~1,000

Saline Storage Estimates (tonnes)

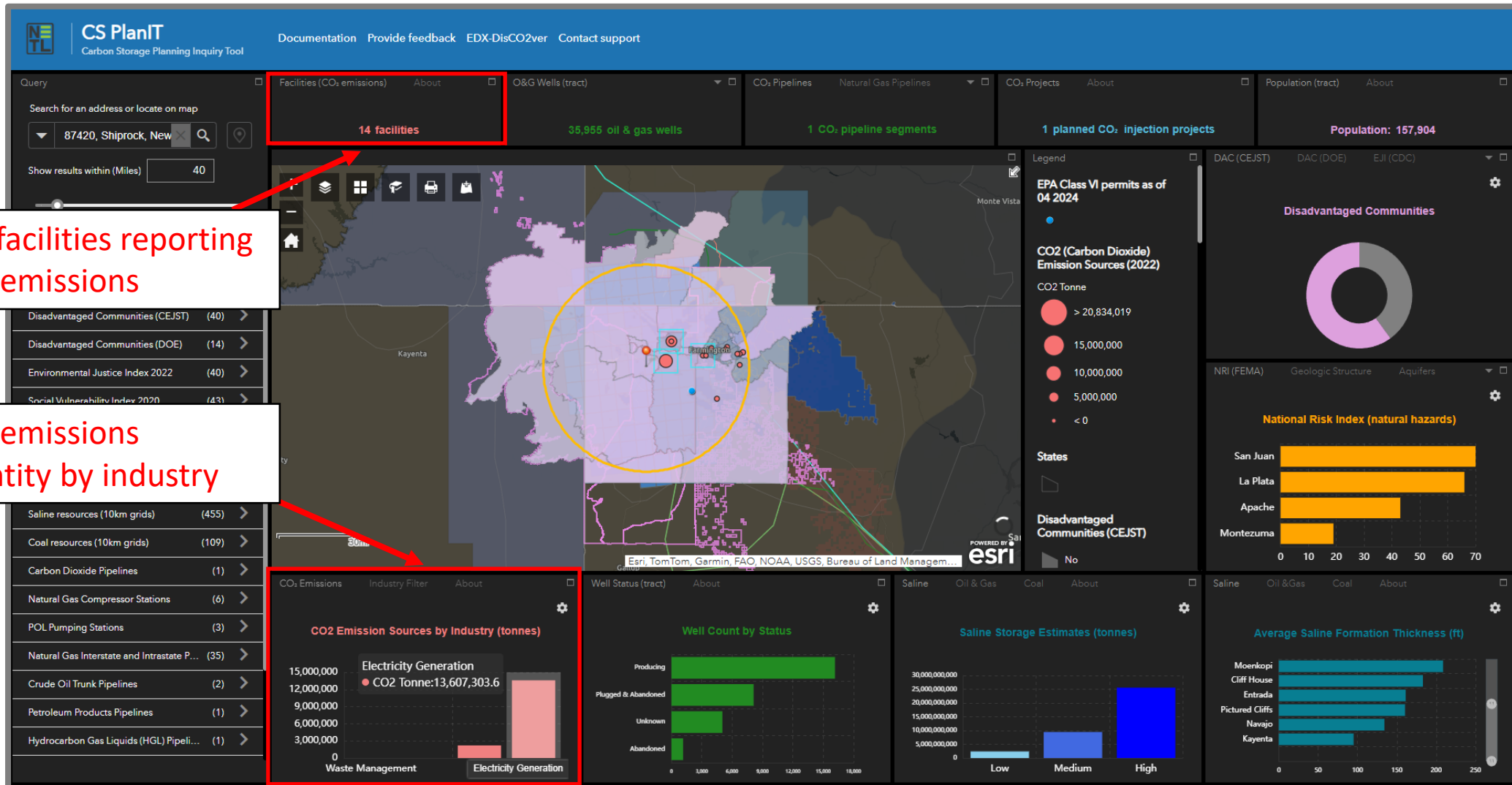
Category	Estimate (tonnes)
Low	~5,000,000,000
Medium	~10,000,000,000
High	~25,000,000,000

Average Saline Formation Thickness (ft)

Location	Thickness (ft)
Moenkopi	~200
Cliff House	~180
Entrada	~150
Pictured Cliffs	~140
Navajo	~120
Kayenta	~100

Explore Your Area of Interest

CO2 emission sources

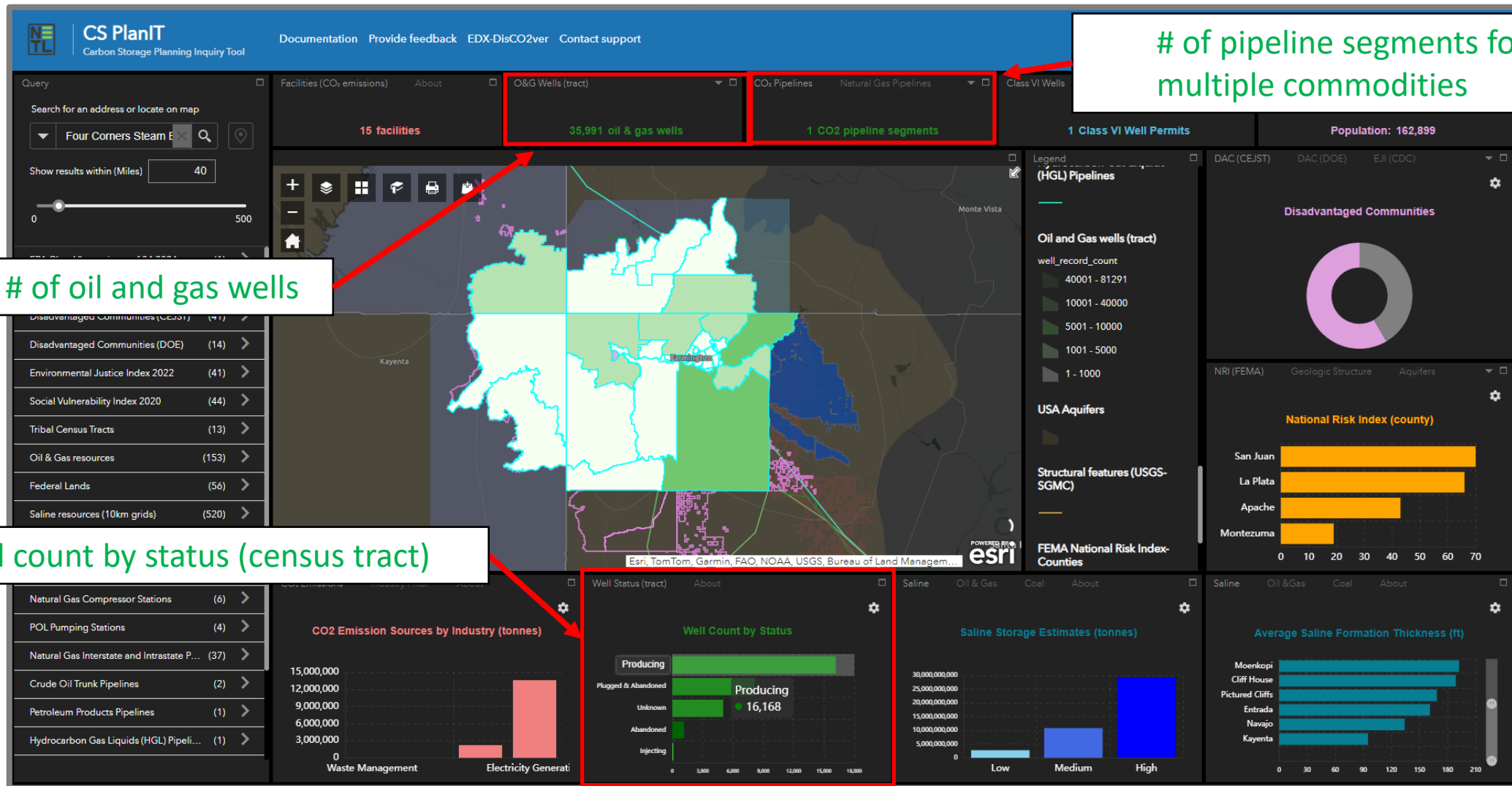


of facilities reporting CO2 emissions

CO2 emissions quantity by industry

Explore Your Area of Interest

Critical energy infrastructure



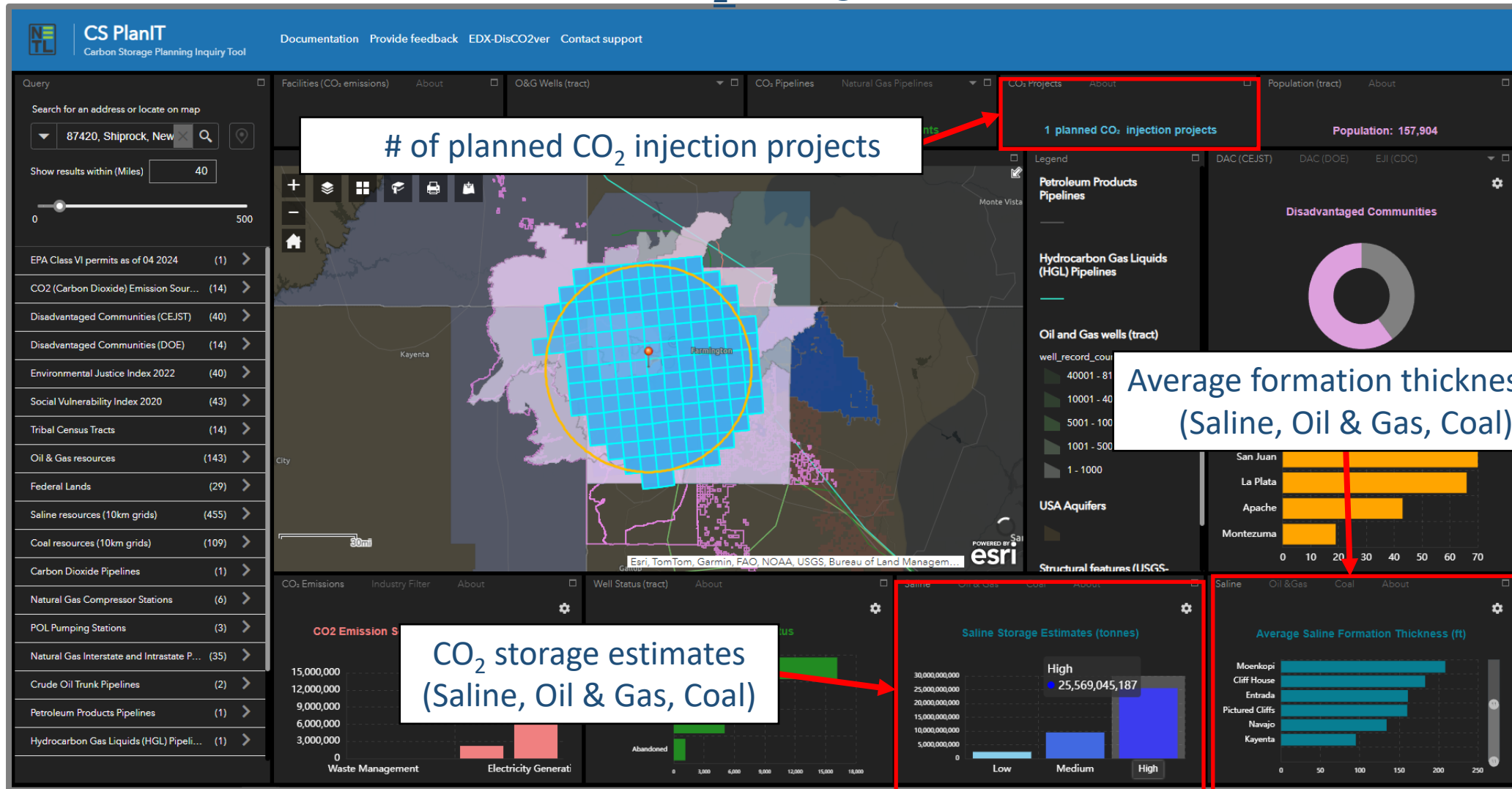
of pipeline segments for multiple commodities

of oil and gas wells

Well count by status (census tract)

Explore Your Area of Interest

CO₂ Storage



of planned CO₂ injection projects

Average formation thicknesses (Saline, Oil & Gas, Coal)

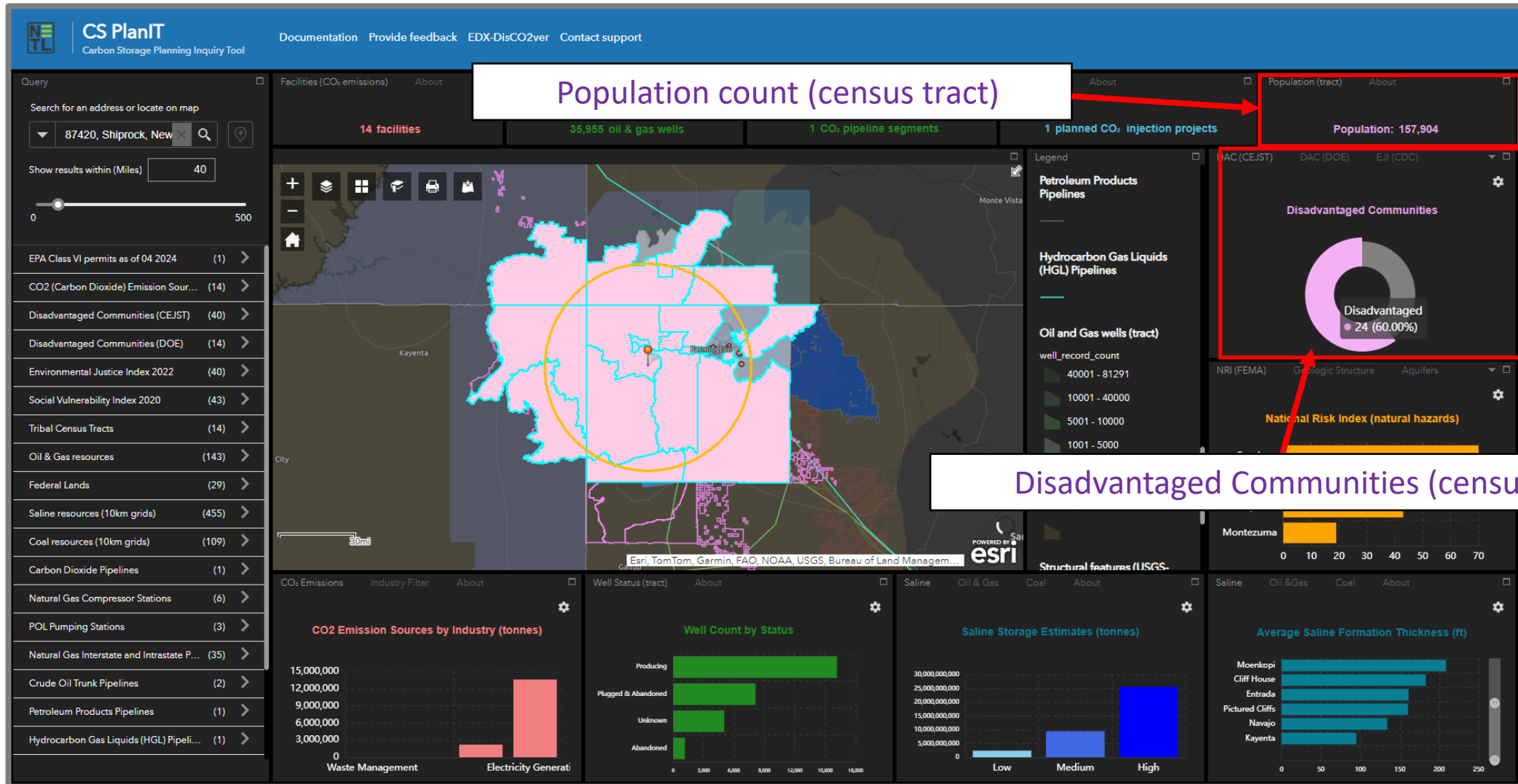
CO₂ storage estimates (Saline, Oil & Gas, Coal)

Saline Storage Estimates (tonnes)
High: 25,569,045,187

Average Saline Formation Thickness (ft)
Moenkopi: ~200
Cliff House: ~180
Entrada: ~150
Pictured Cliffs: ~140
Navajo: ~130
Kayenta: ~120

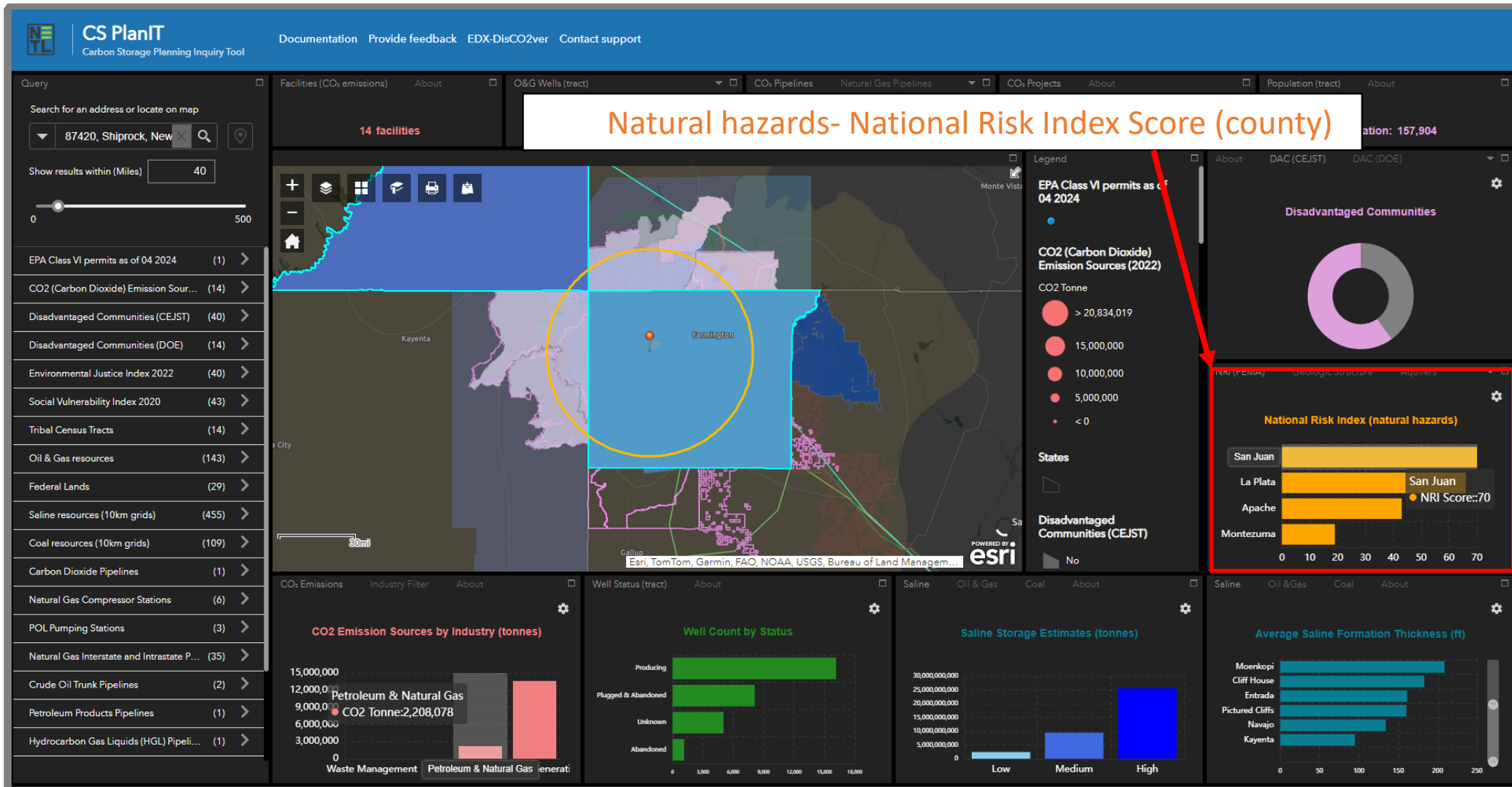
Explore Your Area of Interest

Environmental Justice and Social Justice



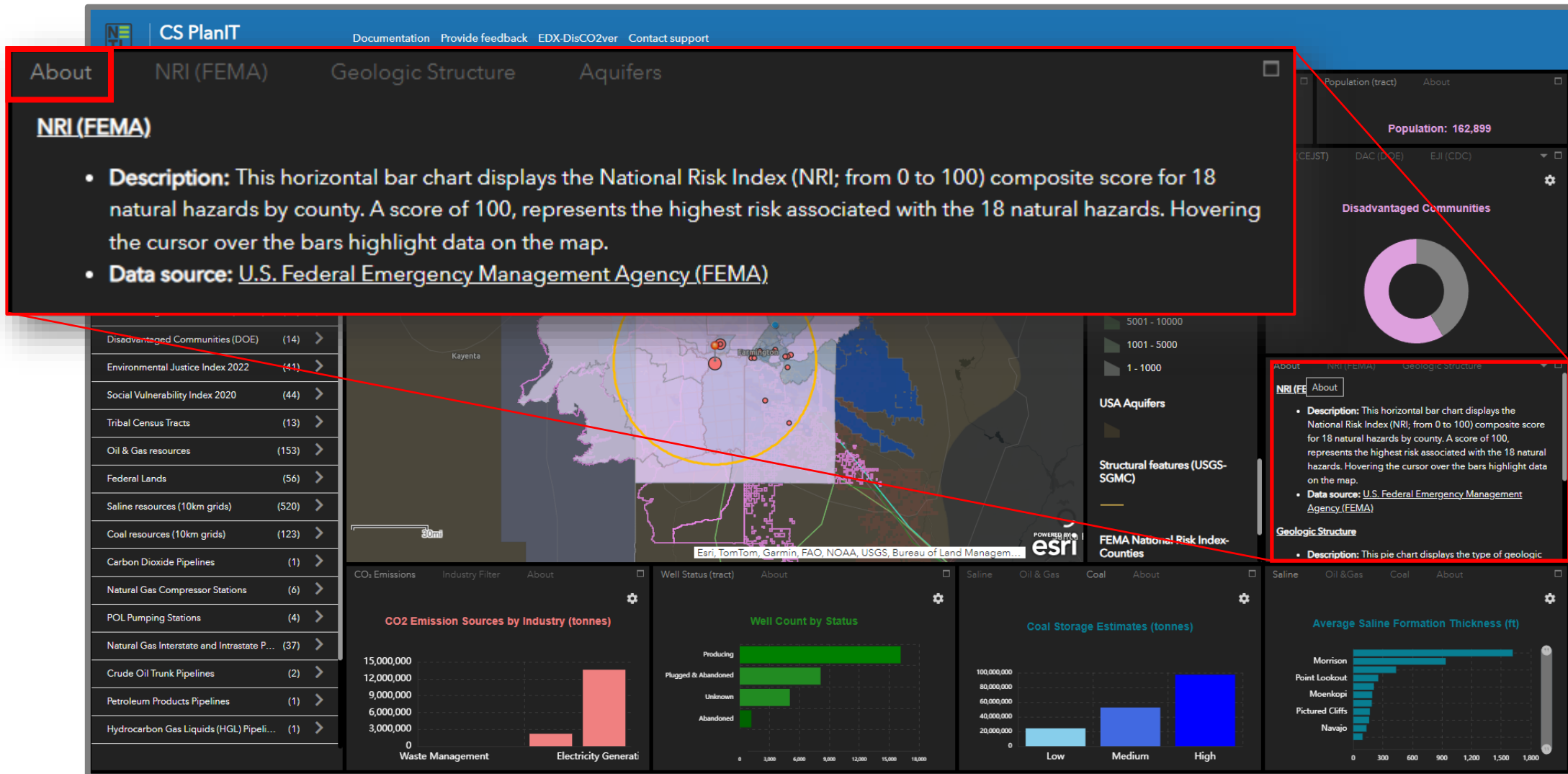
Explore Your Area of Interest

Natural Hazards



Understand Your Area of Interest

“About” tabs



The screenshot shows the CS PlanIT interface with a navigation menu at the top containing 'About', 'NRI (FEMA)', 'Geologic Structure', and 'Aquifers'. The 'About' tab is highlighted with a red box. A large red-bordered overlay box contains the following text:

NRI (FEMA)

- **Description:** This horizontal bar chart displays the National Risk Index (NRI; from 0 to 100) composite score for 18 natural hazards by county. A score of 100, represents the highest risk associated with the 18 natural hazards. Hovering the cursor over the bars highlight data on the map.
- **Data source:** U.S. Federal Emergency Management Agency (FEMA)

The interface also features a sidebar on the left with a list of data layers, a central map of the Kayenta area, and several bottom panels:

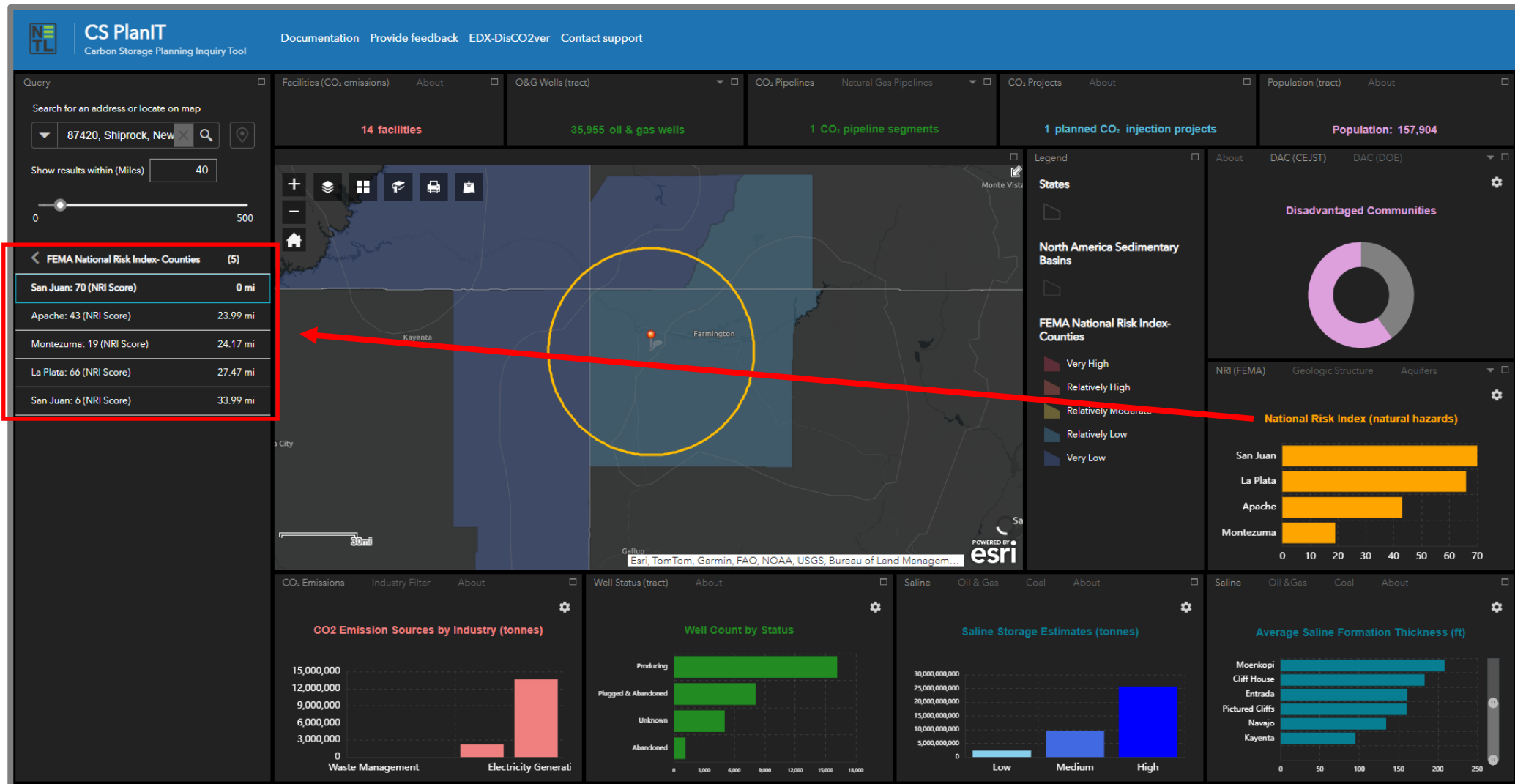
- Disadvantaged Communities (DOE):** (14)
- Environmental Justice Index 2022:** (44)
- Social Vulnerability Index 2020:** (44)
- Tribal Census Tracts:** (13)
- Oil & Gas resources:** (153)
- Federal Lands:** (56)
- Saline resources (10km grids):** (520)
- Coal resources (10km grids):** (123)
- Carbon Dioxide Pipelines:** (1)
- Natural Gas Compressor Stations:** (6)
- POL Pumping Stations:** (4)
- Natural Gas Interstate and Intrastate Pipelines:** (37)
- Crude Oil Trunk Pipelines:** (2)
- Petroleum Products Pipelines:** (1)
- Hydrocarbon Gas Liquids (HGL) Pipelines:** (1)

Bottom panels include:

- CO2 Emission Sources by Industry (tonnes):** A bar chart showing emissions for Waste Management and Electricity Generation.
- Well Count by Status:** A horizontal bar chart showing counts for Producing, Plugged & Abandoned, Unknown, and Abandoned wells.
- Coal Storage Estimates (tonnes):** A bar chart showing estimates for Low, Medium, and High storage levels.
- Average Saline Formation Thickness (ft):** A horizontal bar chart showing thickness for Morrison, Point Lookout, Moenkopi, Pictured Cliffs, and Navajo formations.

Additional elements include a legend for 'USA Aquifers' and 'Structural features (USGS-SGMC)', a 'FEMA National Risk Index-Counties' legend, and a 'Disadvantaged Communities' donut chart showing a population of 162,899.

Understand Your Area of Interest



Understand Your Area of Interest

CS PlanIT
Carbon Storage Planning Inquiry Tool

Documentation Provide feedback EDX-DisCO2ver

Query

Search for an address or locate on map

Four Corners Steam E

Show results within (Miles) 40

0 500

FEMA National Risk Index- Counties

Approximate Distance: 0 mi

San Juan: 70 (NRI Score)

San Juan County
New Mexico
County Info

Population (2020)	121,421
Building Value (\$)	21,668,319,414.00
Agricultural Value (\$)	84,998,275.00
Area (sq mi)	5,594.34

Ratings Summary

Risk Index	Relatively Low
Expected Annual Loss	Relatively Low
Social Vulnerability	Very High
Community Resilience	Very Low

Overview Risk Index

Rating	Relatively Low
Score	70
National Percentile	
State Percentile	72.73

Expected Annual Loss

Rating	Relatively Low
Score	58.96
National Percentile	
State Percentile	69.70
Total (\$)	7,302,057.01
Building Value (\$)	1,005,771.29

FEMA National Risk Index- Counties

Approximate Distance: 0 mi

San Juan: 70 (NRI Score)

San Juan County
New Mexico
County Info

Population (2020)	121,421
Building Value (\$)	21,668,319,414.00
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Ratings Summary

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Overview Risk Index

Rating	Relatively Low
Score	70
National Percentile	
State Percentile	72.73

Expected Annual Loss

Rating	Relatively Low
Score	58.96
National Percentile	
State Percentile	69.70
Total (\$)	7,302,057.01
Building Value (\$)	1,005,771.29

1 planned CO₂ injection projects

Population: 162,899

Legend

States

Counties

North America Sedimentary Basins

FEMA National Risk Index- Counties

- Very High
- Relatively High
- Relatively Moderate
- Relatively Low
- Very Low

Disadvantaged Communities

National Risk Index (county)

San Juan	70
La Plata	65
Apache	45
Montezuma	20

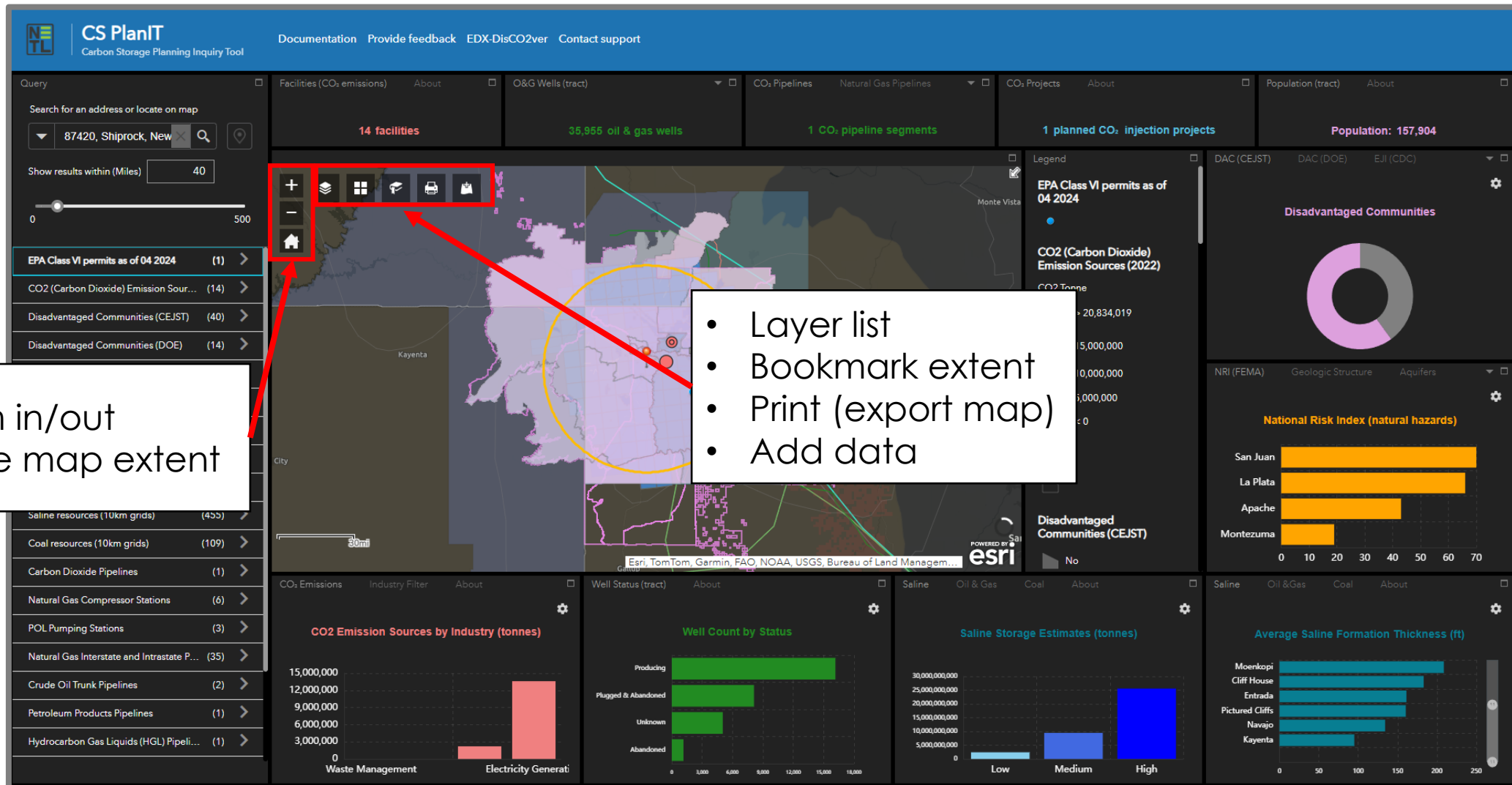
CO₂ Emission Sources by Industry (tonnes)

Saline Storage Estimates (tonnes)

Average Saline Formation Thickness (ft)

Moenkopi	180
Cliff House	170
Pictured Cliffs	160
Entrada	150
Navajo	140
Kayenta	100

Customize Your Area of Interest



CS PlanIT
Carbon Storage Planning Inquiry Tool

Documentation Provide feedback EDX-DisCO2ver Contact support

Query

Search for an address or locate on map

87420, Shiprock, New Mexico

Show results within (Miles) 40

0 500

EPA Class VI permits as of 04 2024 (1)

CO2 (Carbon Dioxide) Emission Sources (14)

Disadvantaged Communities (CEJST) (40)

Disadvantaged Communities (DOE) (14)

Saline resources (10km grids) (435)

Coal resources (10km grids) (109)

Carbon Dioxide Pipelines (1)

Natural Gas Compressor Stations (6)

POL Pumping Stations (3)

Natural Gas Interstate and Intrastate Pipelines (35)

Crude Oil Trunk Pipelines (2)

Petroleum Products Pipelines (1)

Hydrocarbon Gas Liquids (HGL) Pipelines (1)

Facilities (CO2 emissions) 14 facilities

O&G Wells (tract) 35,955 oil & gas wells

CO2 Pipelines 1 CO2 pipeline segments

CO2 Projects 1 planned CO2 injection projects

Population (tract) Population: 157,904

Legend

EPA Class VI permits as of 04 2024

CO2 (Carbon Dioxide) Emission Sources (2022)

CO2 Tonne

20,834,019

15,000,000

10,000,000

5,000,000

0

Disadvantaged Communities

NRI (FEMA) Geologic Structure Aquifers

National Risk Index (natural hazards)

San Juan

La Plata

Apache

Montezuma

0 10 20 30 40 50 60 70

CO2 Emissions Industry Filter

Well Status (tract)

Saline Oil & Gas Coal

CO2 Emission Sources by Industry (tonnes)

Well Count by Status

Saline Storage Estimates (tonnes)

Average Saline Formation Thickness (ft)

Producing

Plugged & Abandoned

Unknown

Abandoned

Low Medium High

Moenkopi

Cliff House

Entrada

Pictured Cliffs

Navajo

Kayenta

0 50 100 150 200 250

Waste Management Electricity Generation

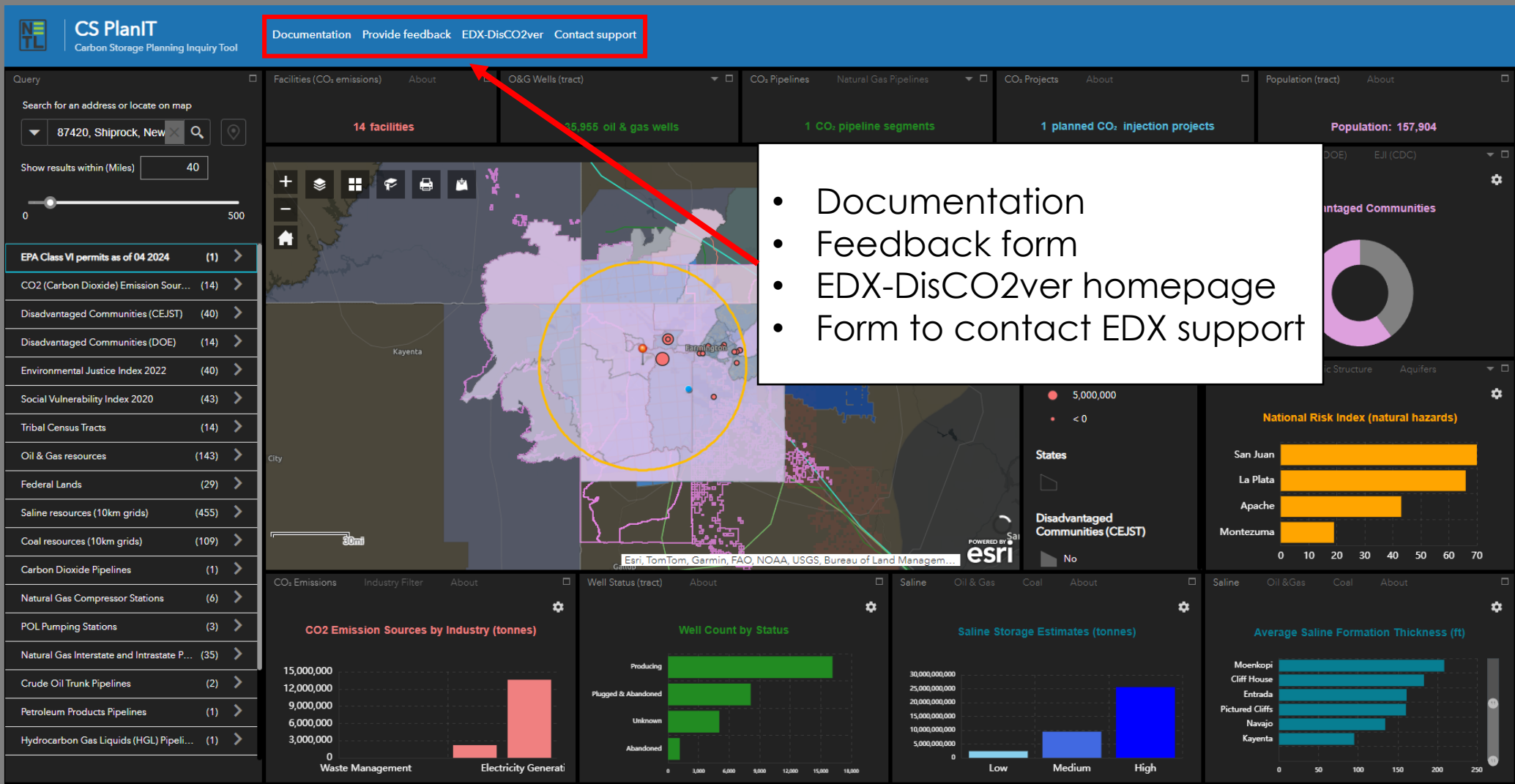
0 3,000 6,000 9,000 12,000 15,000

0 5,000,000 10,000,000 15,000,000 20,000,000 25,000,000 30,000,000

0 50 100 150 200 250

- Zoom in/out
- Home map extent
- Layer list
- Bookmark extent
- Print (export map)
- Add data

Link to External Websites



CS PlanIT
Carbon Storage Planning Inquiry Tool

Documentation Provide feedback EDX-DisCO2ver Contact support

Search for an address or locate on map
87420, Shiprock, New Mexico

Show results within (Miles) 40

14 facilities
35,955 oil & gas wells
1 CO2 pipeline segments
1 planned CO2 injection projects
Population: 157,904

- Documentation
- Feedback form
- EDX-DisCO2ver homepage
- Form to contact EDX support

CO2 Emission Sources by Industry (tonnes)

Industry	CO2 Emission Sources (tonnes)
Waste Management	~1,000,000
Electricity Generation	~13,000,000

Well Count by Status

Status	Well Count
Producing	~11,000
Plugged & Abandoned	~8,000
Unknown	~5,000
Abandoned	~1,000

Saline Storage Estimates (tonnes)

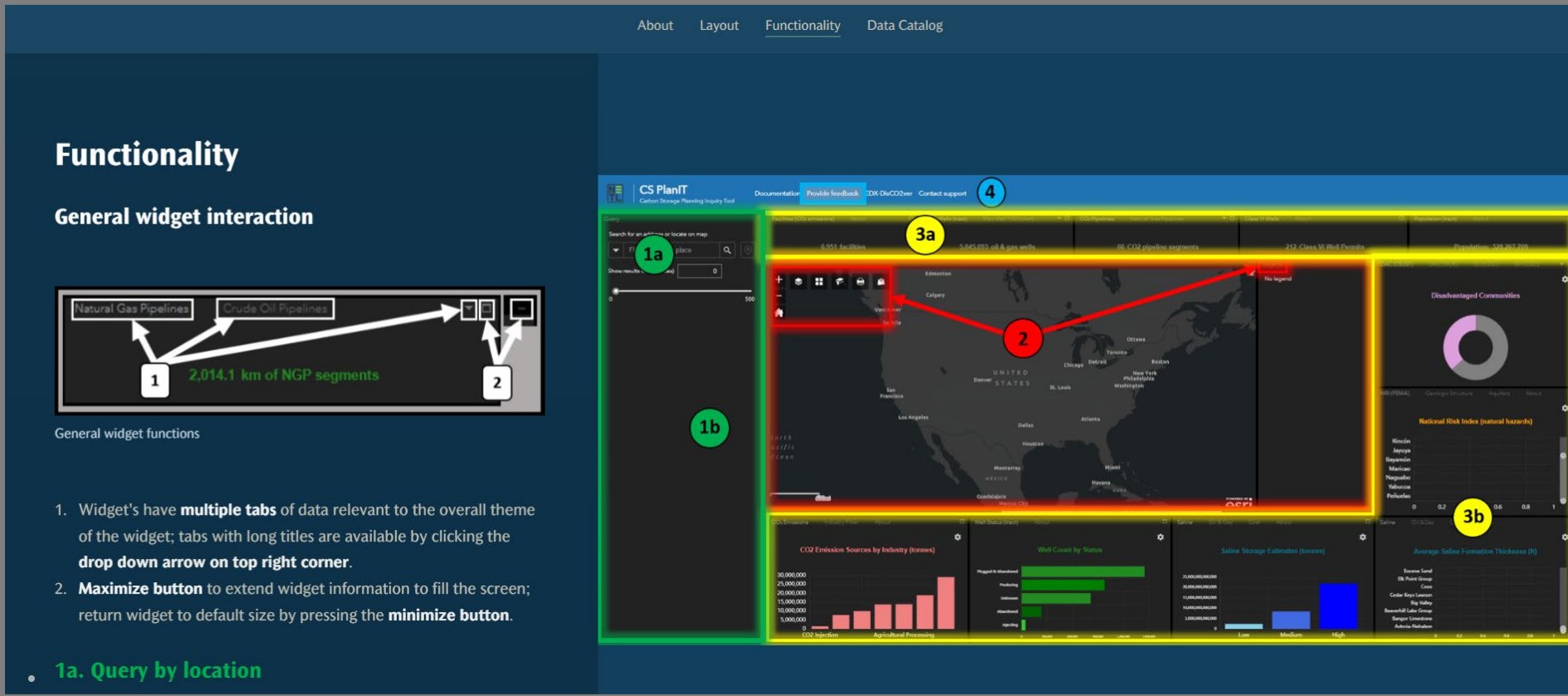
Category	Saline Storage Estimates (tonnes)
Low	~5,000,000,000
Medium	~10,000,000,000
High	~25,000,000,000

Average Saline Formation Thickness (ft)

Location	Average Saline Formation Thickness (ft)
Moenkopi	~200
Cliff House	~180
Entrada	~150
Pictured Cliffs	~140
Navajo	~130
Kayenta	~100

CS PlanIT documentation web page

- Web page with 4 sections:
 - **About**
 - **Layout**
 - **Functionality**
 - **Data Catalog**



Functionality

General widget interaction

Natural Gas Pipelines Crude Oil Pipelines

2,014.1 km of NGP segments

1 2

General widget functions

1. Widget's have **multiple tabs** of data relevant to the overall theme of the widget; tabs with long titles are available by clicking the **drop down arrow on top right corner**.
2. **Maximize button** to extend widget information to fill the screen; return widget to default size by pressing the **minimize button**.

• **1a. Query by location**

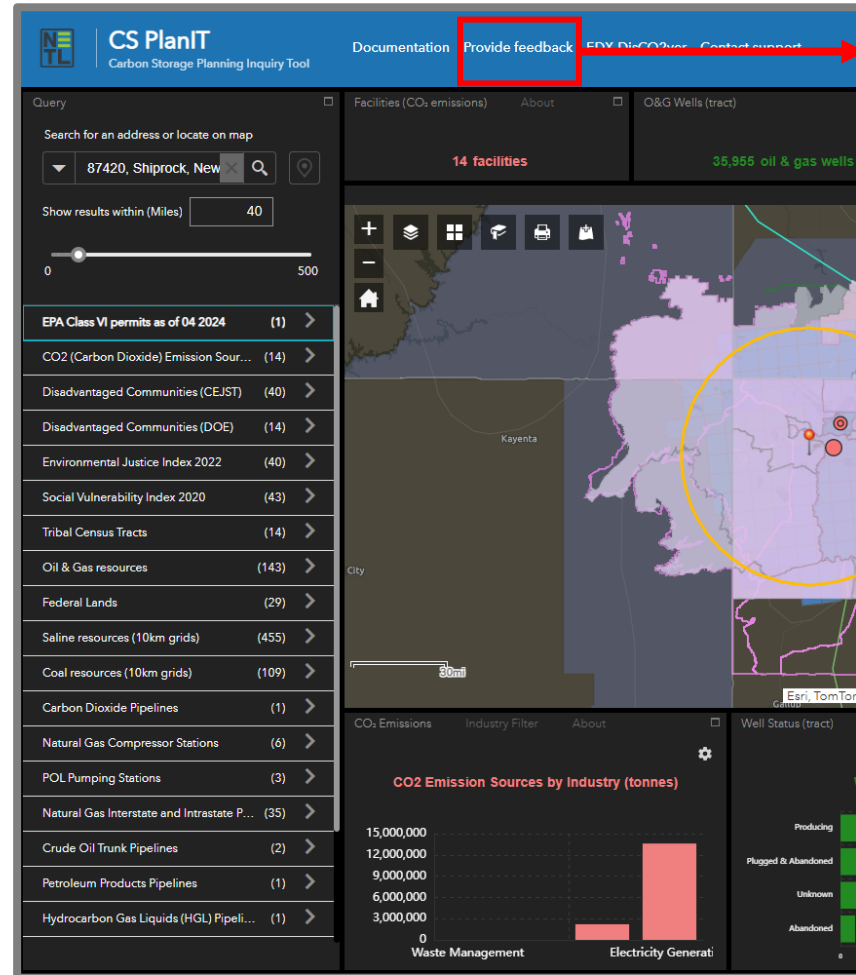
CS PlanIT
Carbon Storage Planning Inquiry Tool

Documentation Provide feedback DOK DisCO2ver Contact support 4

1a 1b 2 3a 3b

Provide Feedback

- CS PlanIT Feedback Form
- Users can rate and comment on aspects of the tool



CS PlanIT Feedback Form

Name*

Organization*

Date*

List or describe data/statistics preferences*

Responsiveness

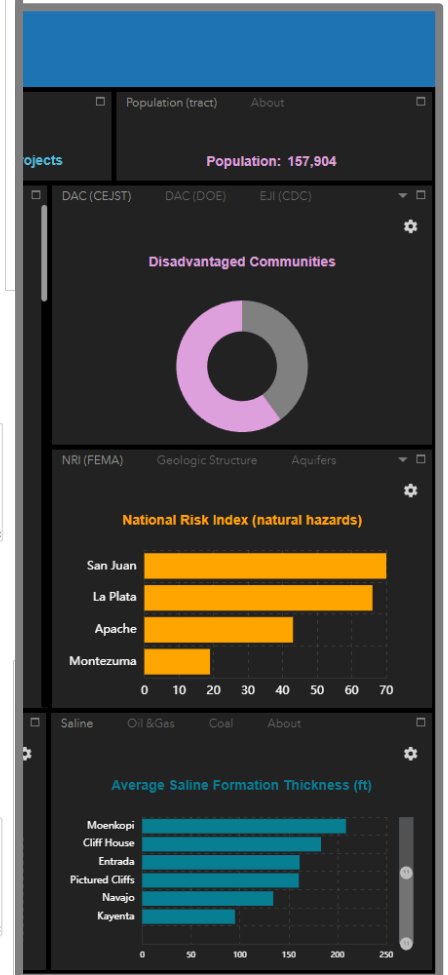
☆☆☆☆☆

Layout

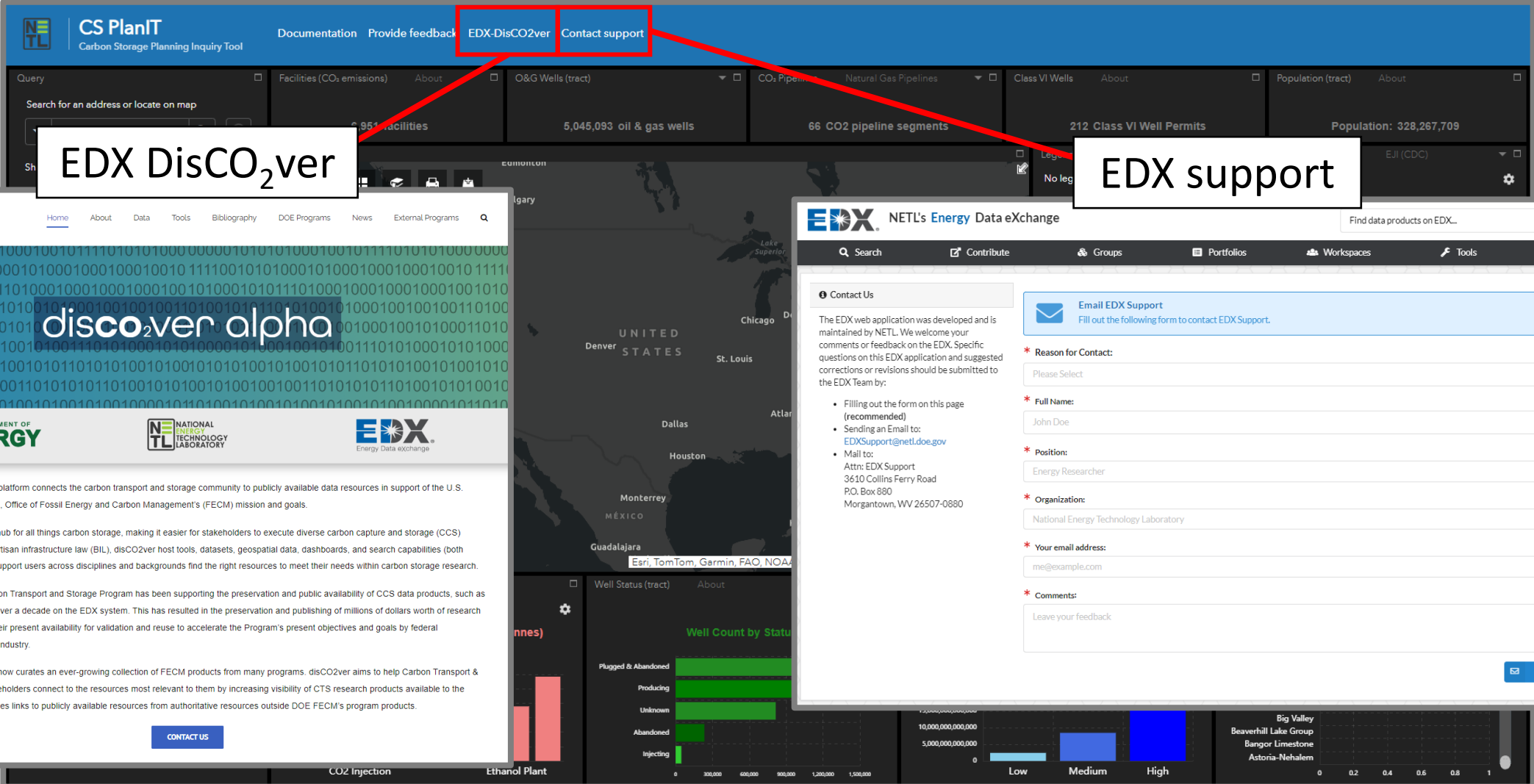
☆☆☆☆☆

General comments/issues/suggestions*

Submit



Links to Key Resources



The screenshot shows the CS PlanIT Carbon Storage Planning Inquiry Tool interface. At the top, there are navigation links: "Documentation", "Provide feedback", "EDX-DisCO₂ver", and "Contact support". The "EDX-DisCO₂ver" and "Contact support" links are highlighted with red boxes and red arrows pointing to callout boxes labeled "EDX DisCO₂ver" and "EDX support" respectively.

The "EDX DisCO₂ver" callout points to the "discover alpha" website. The "EDX support" callout points to the "Contact Us" form on the EDX website.

discover alpha

U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY | EDX Energy Data eXchange

The EDX-hosted disCO₂ver platform connects the carbon transport and storage community to publicly available data resources in support of the U.S. Department of Energy (DOE), Office of Fossil Energy and Carbon Management's (FECM) mission and goals.

EDX disCO₂ver is a central hub for all things carbon storage, making it easier for stakeholders to execute diverse carbon capture and storage (CCS) projects. Funded by the bipartisan infrastructure law (BIL), disCO₂ver host tools, datasets, geospatial data, dashboards, and search capabilities (both within and outside EDX) to support users across disciplines and backgrounds find the right resources to meet their needs within carbon storage research.

The U.S. DOE FECM's Carbon Transport and Storage Program has been supporting the preservation and public availability of CCS data products, such as data, models, and tools, for over a decade on the EDX system. This has resulted in the preservation and publishing of millions of dollars worth of research project products, ensuring their present availability for validation and reuse to accelerate the Program's present objectives and goals by federal researchers, academia, and industry.

EDX, first launched in 2011, now curates an ever-growing collection of FECM products from many programs. disCO₂ver aims to help Carbon Transport & Storage (CTS) program stakeholders connect to the resources most relevant to them by increasing visibility of CTS research products available to the public. disCO₂ver also includes links to publicly available resources from authoritative resources outside DOE FECM's program products.

[CONTACT US](#)

EDX NETL's Energy Data eXchange

Find data products on EDX...

Contact Us

The EDX web application was developed and is maintained by NETL. We welcome your comments or feedback on the EDX. Specific questions on this EDX application and suggested corrections or revisions should be submitted to the EDX Team by:

- Filling out the form on this page (recommended)
- Sending an Email to: EDXSupport@netl.doe.gov
- Mail to: Attn: EDX Support, 3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507-0880

Email EDX Support
Fill out the following form to contact EDX Support.

* Reason for Contact:
Please Select

* Full Name:
John Doe

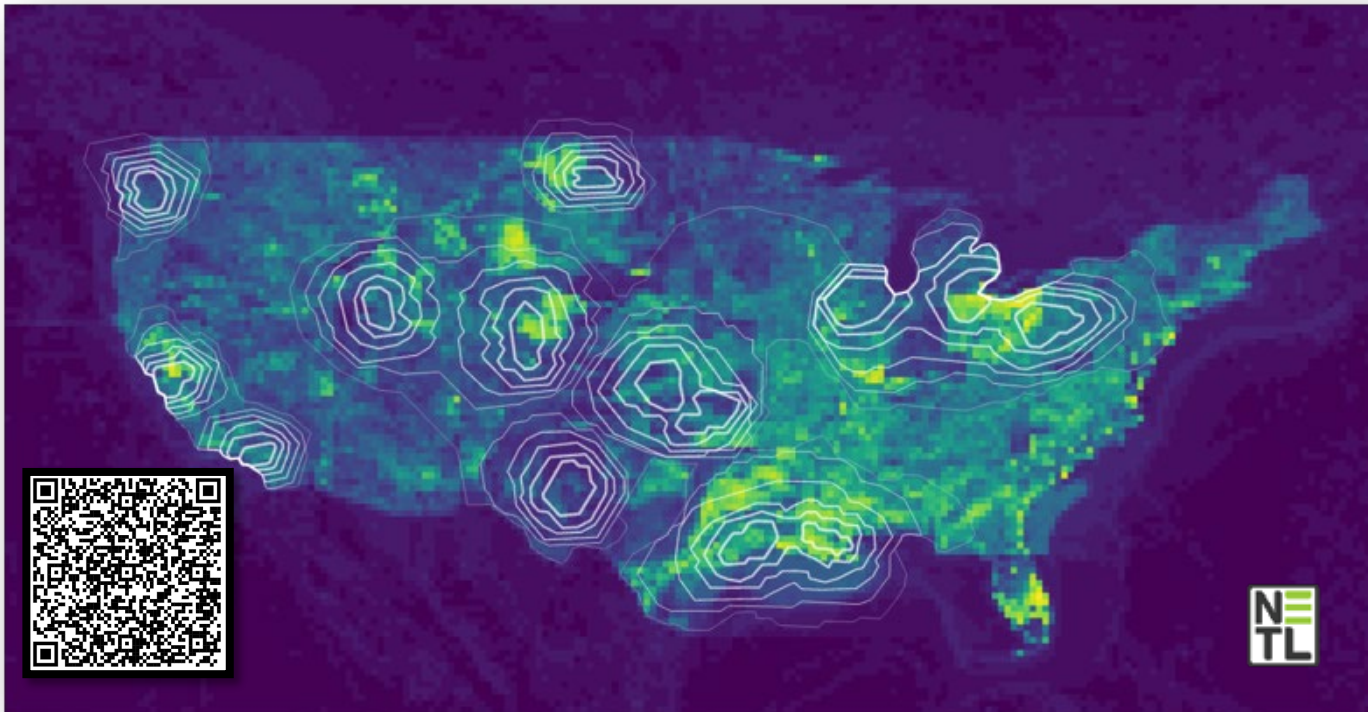
* Position:
Energy Researcher

* Organization:
National Energy Technology Laboratory

* Your email address:
me@example.com

* Comments:
Leave your feedback

[Email EDX Support](#)



Carbon Storage Technical Viability Assessment (CS TVA) data density analysis (brighter green, higher data density) overlain by white contour lines highlighting Great Plains Institute Carbon Storage Hub locations (Abramson, 2022). Analysis performed using the CSIL (Cumulative Spatial Impact Layers) tool (Romeo et al., 2019).

Next steps/Challenges:

- Evaluating and integrating key data from **CS TVA (Carbon Storage Technical Viability Assessment) database** (EDX4CCS portfolio)
- Build out and adjusting tool layout and functionality
- **Release of CS PlanIT v2.0 (April 2025)**

<https://edx.netl.doe.gov/dataset/edx4ccs-carbon-storage-technical-viability-approach-database>

Carbon Storage Planning Inquiry Tool (CS PlanIT) v1.0

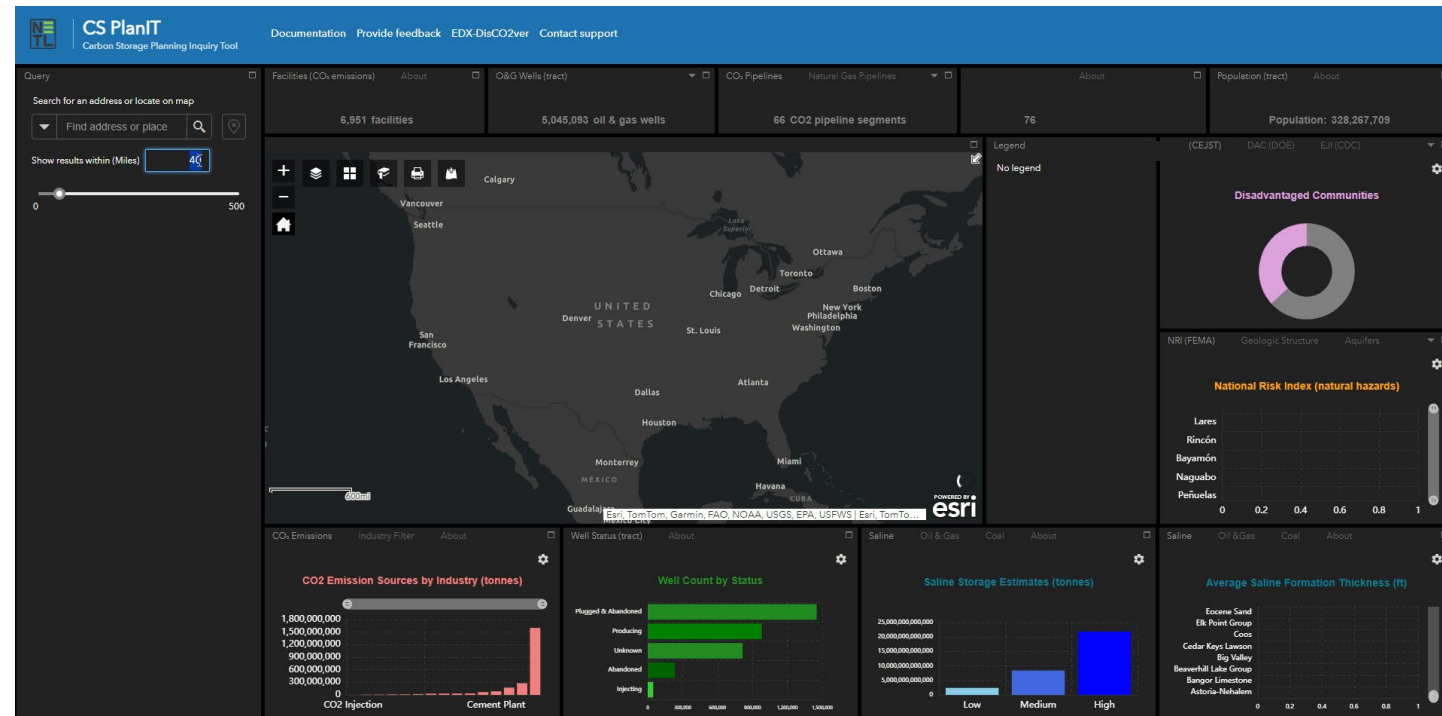


Ultimate outcomes

- Version 1 available as of 6/30/2024
- Version 2 with data integrated from the CS TVA (Carbon Storage Technical Viability Assessment) database (release April 2025)

Stakeholder benefit

- Quick and efficient access and insights into key CS datasets (including geologic, technical, environmental, social) to support CCS planning, feasibility, and resource assessment efforts.
- Results can be leveraged to inform carbon storage resource and feasibility assessments



<https://edx.netl.doe.gov/dataset/cs-planit-carbon-storage-planning-inquiry-tool>



<https://edx.netl.doe.gov/site/s/disco2ver-alpha/>

DEMO & POSTER SESSION

TUESDAY, AUGUST 6, 2024

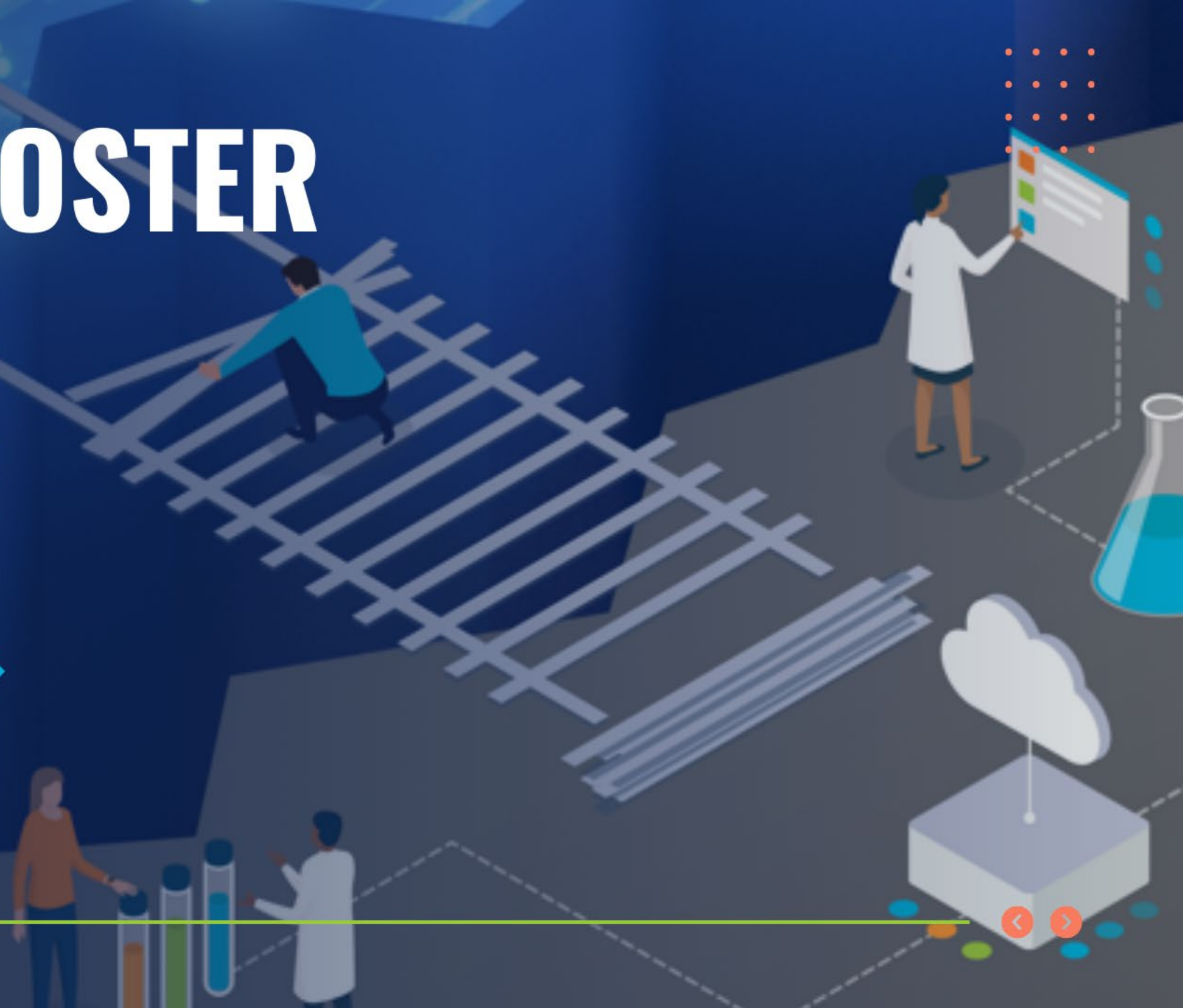
5:45 PM - 7:45PM

BALLROOM GALLERY

CS PlanIT
(Carbon Storage
Planning Inquiry Tool)



CARBON TRANSPORT & STORAGE DATA AND
INNOVATION TO BRIDGE THE DIGITAL DIVIDE



NETL Carbon Storage Outreach Example

2024 FECM/NETL Carbon Management Research Project Review Meeting

100+ DOE-sponsored CTS presentations

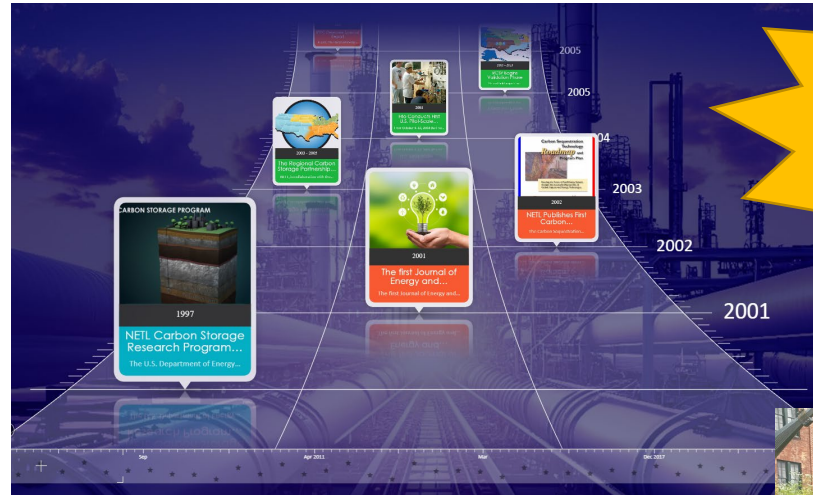
Presentations on EY23 CTS work:

- Advanced Storage FWP
- Carbon Storage Data FWP
- Carbon Storage Analysis FWP
- Multi-Modal Transportation FWP
- EDX4CCS
- NRAP
- SMART

Open to the public

Attendees from government agencies, utilities, research, universities, industry

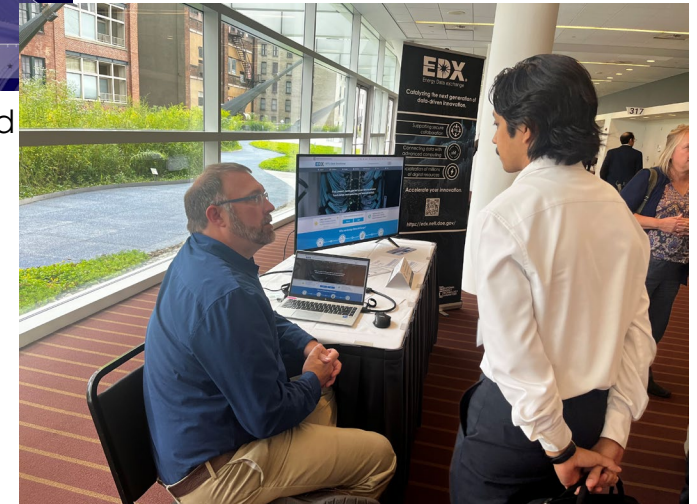
Poster and tool/app demo session – Tuesday Aug. 6th evening



**Aug. 5-9, 2024
Pittsburgh
Convention
Center**

Carbon Storage Timeline summarizing field, lab and computational contributions to CTS' digital future
Live, interactive demo at the booth!
Source: NETL

**Stop by the CTS booth in the exhibit hall to learn more!
Take-aways, information, expertise in one stop shop**



Multiple tool demos will be hosted
Source: NETL

References



Abramson et al. (2022) An Atlas of Carbon and Hydrogen Hubs for United States Decarbonization. Great Plains Institute, https://scripts.betterenergy.org/CarbonCaptureReady/GPI_Carbon_and_Hydrogen_Hubs_Atlas.pdf

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