CO_2-Locate

A Living National Well Database

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NATIONAL ENERGY TECHNOLOGY LABORATORY

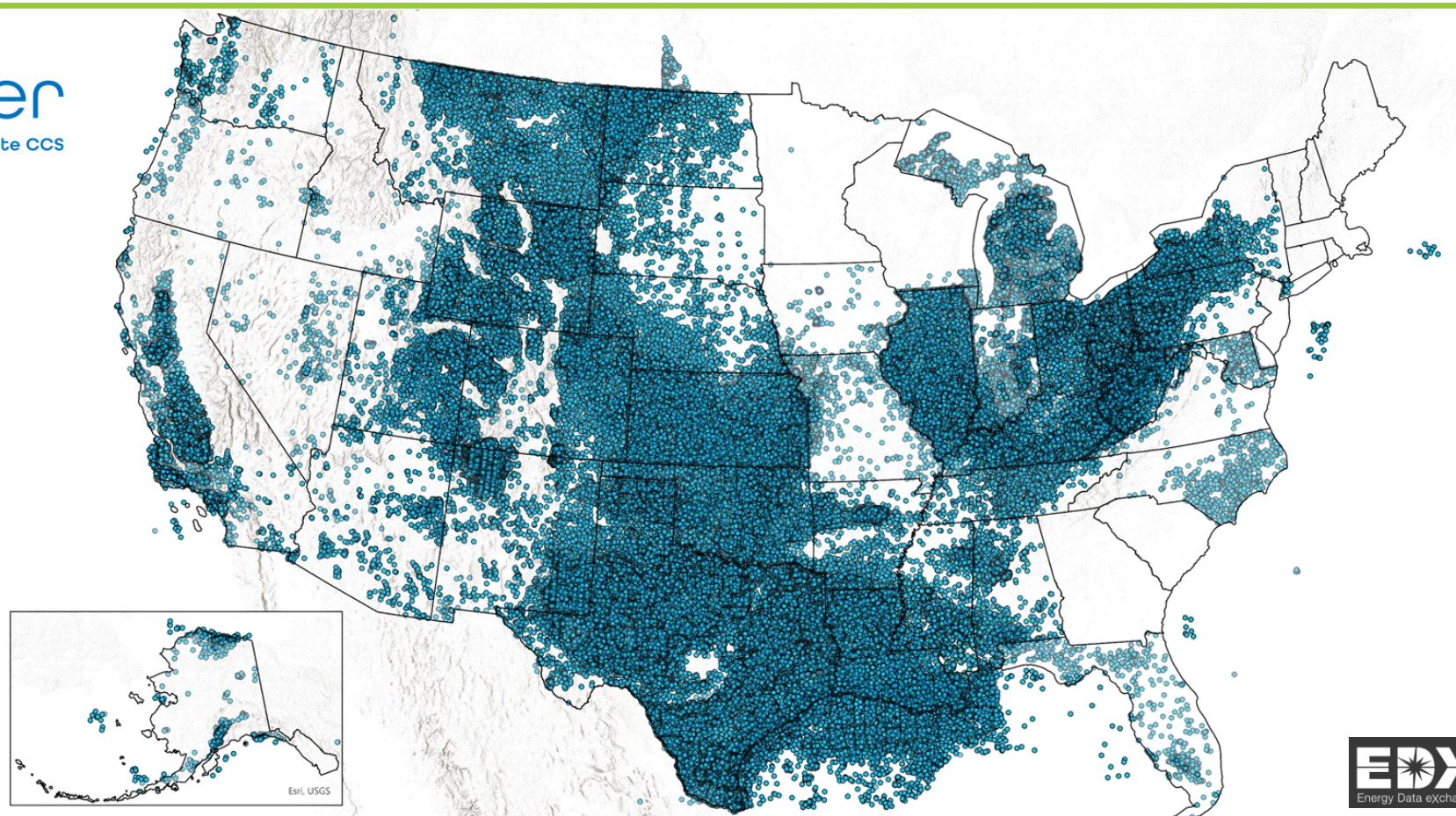
2024 FECM/NETL Carbon Management Research Project Review Meeting

Aug. 5, 2024

EDX SPATIAL

discover Data Infrastructure to Accelerate CCS

BIL



U.S. DEPARTMENT OF ENERGY

EDX 4CCS Energy Data eXchange

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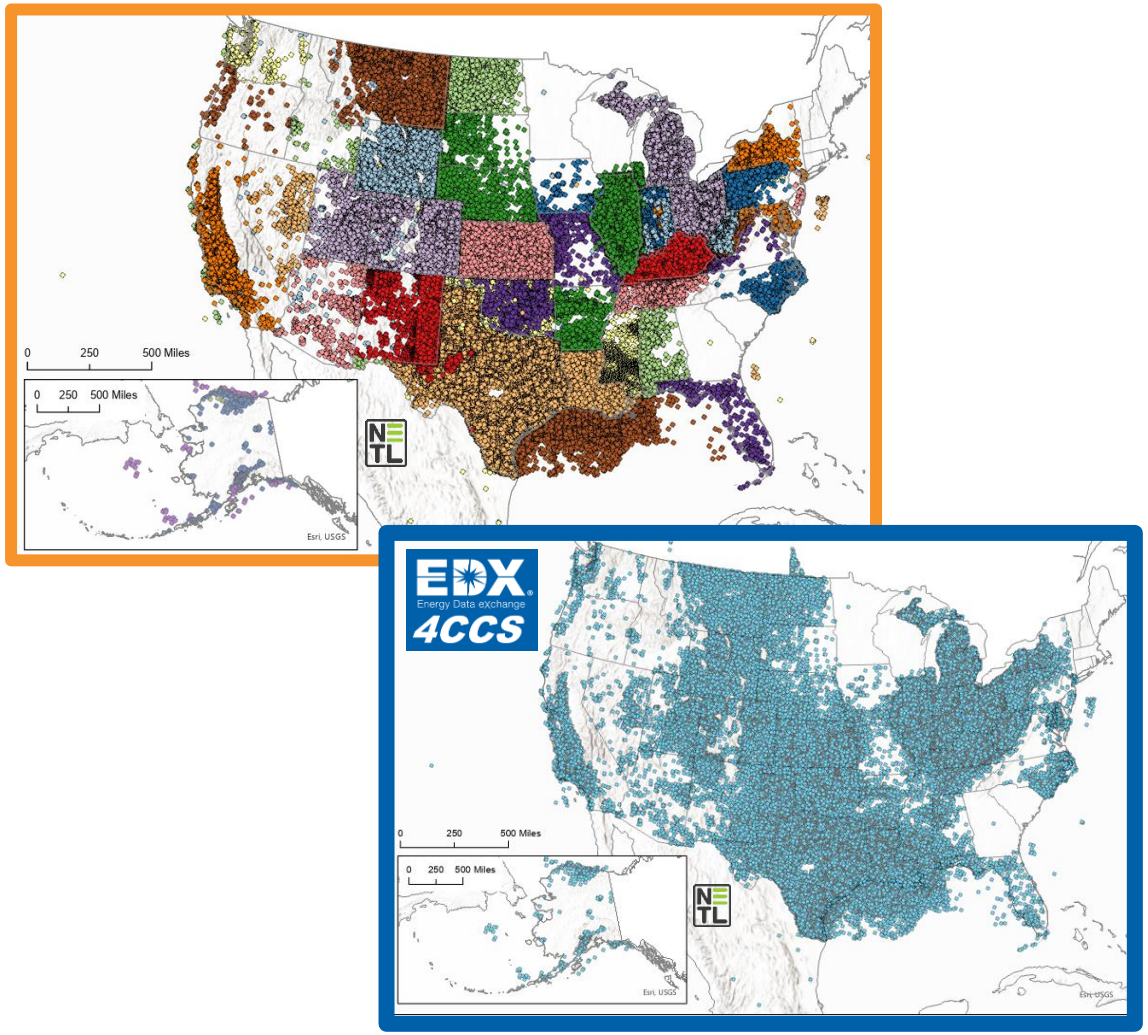
Inform CTS Needs with Big, Geospatial Data Integration

Challenge & Solution



Challenge: **Well infrastructure data** are **disparate** and **siloed** by multiple entities. Stakeholders have requested the integration of these resources to better understand national energy resources & opportunities.

Solution: Create an **integrated, *living* national well database** from credible state, tribal, and federal entities.

Stakeholders

Industry
Regulators
Researchers

Delivering Integrated, Up-to-date Resources

Objectives & Outcomes

Objectives:

POP: *EY22 – EY24*

1. **Integrate disparate, open-source well data** to inform CTS projects
2. Provide a **reliable, self-updating resource** to **help permitting**, **site selection**, and **risk assessments**
3. **Support CTS stakeholder needs** and **national decarbonization**

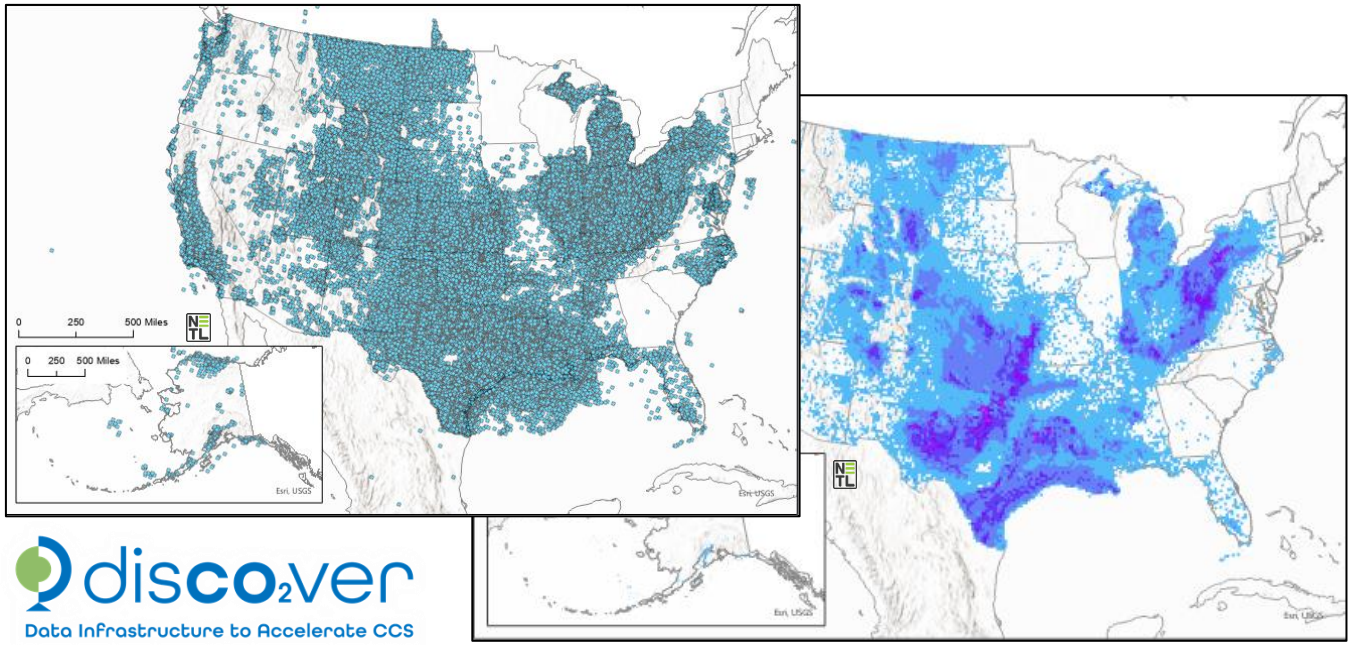
Advancing DOE Program Goals

Delivering ***geospatial technologies*** **informing safe** and **efficient** ***domestic carbon management planning and development***

Public Resources

CO_2-Locate

CO_2-Locate Application



EDX Energy Data eXchange 4CCS

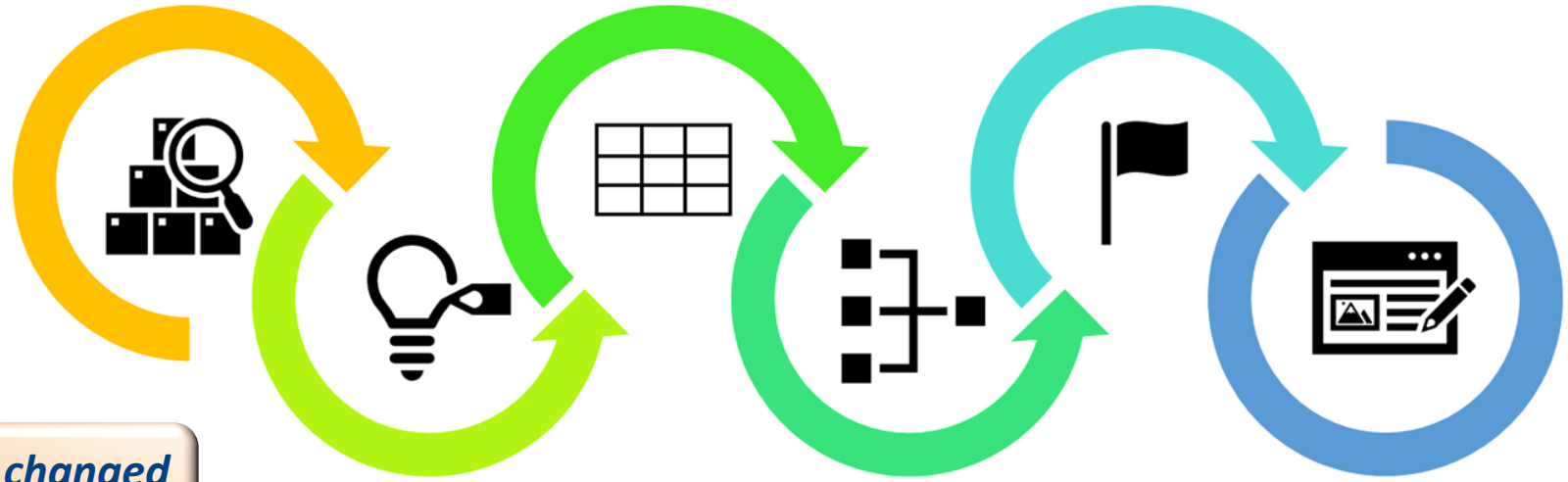
discover Data Infrastructure to Accelerate CCS

Building a Transparent, Living Database

Technical Approach to Integration & Standardization

- **Target datasets**
  - Oil and gas wells, surface hole locations
  - Authoritative sources
- Catalog **metadata**
  - ***Attribute mapping schema***
    - Definitions
    - Units
    - Formats (e.g., text, date)
  - **Acquisition/processing** methods
- **Automated** in Python
- Quality control **curation**
- Published on **EDX DisCO$_2$ver**

Easily changed and updated!



ACQUIRE

Well data and **metadata** are gathered from credible sources

RELATE

Join well records based off common attributes, formats & units

FLAG

Flag data to identify well data or characteristics of interest (e.g., marginal wells)

PROCESS

Transform original datasets into common file formats

INTEGRATE

Compile original data and attributes into a uniform resource

SHARE

Enable access to data & metadata for usability

A Comprehensive, Open-Source Database

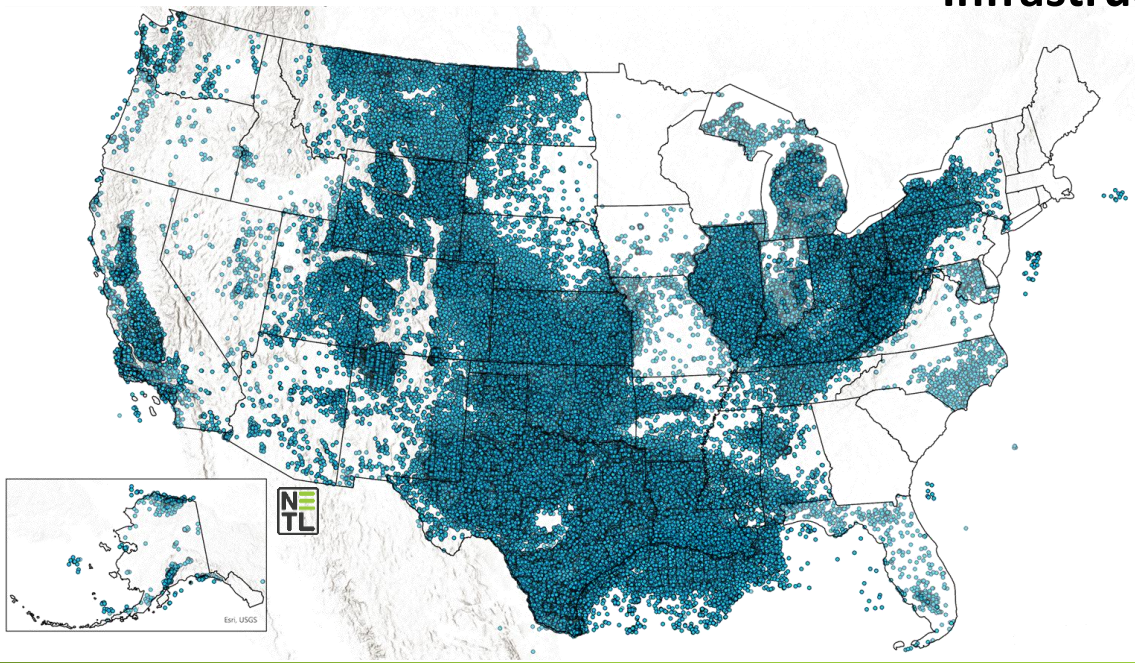
CO_2-Locate: A Baseline of Well Data

Integrated & original layers

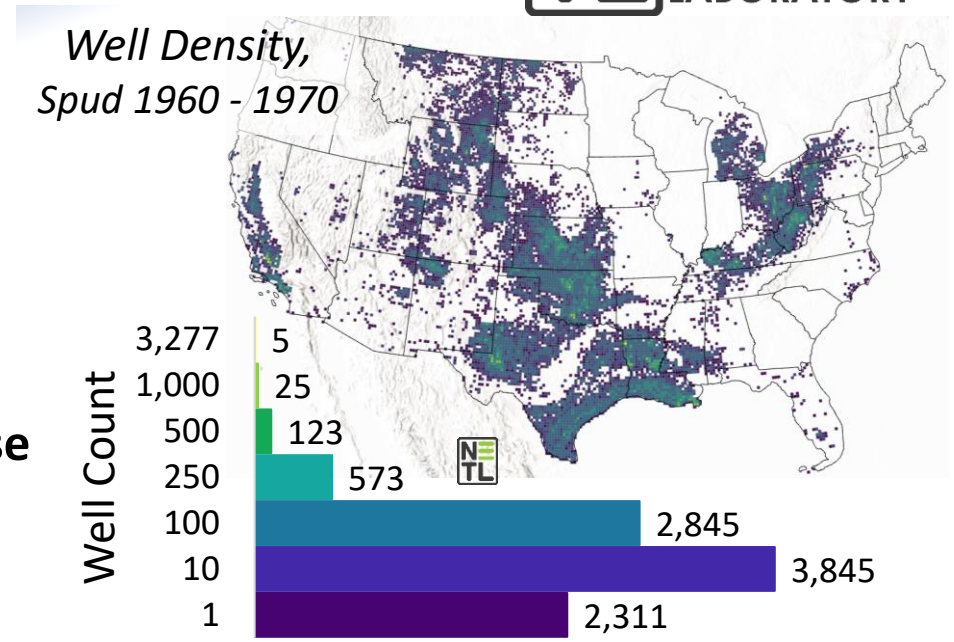
- **60+** resources
  - **+1k attributes**
  - **+15 million total records**

- **Analytical spatial aggregations** (Enverus)
  - *Ex. Spud, status, depth, production rate*

- **Global Oil and Gas Infrastructure Database**



Well Density, Spud 1960 - 1970



Values Delivered

- **Unified, up-to-date public resource** with **direct links** to **original sources**
- Designed to **deliver critical insights supporting permitting** and **safe operations**
- **FAIR** resource enables **cross-cutting quick wins**

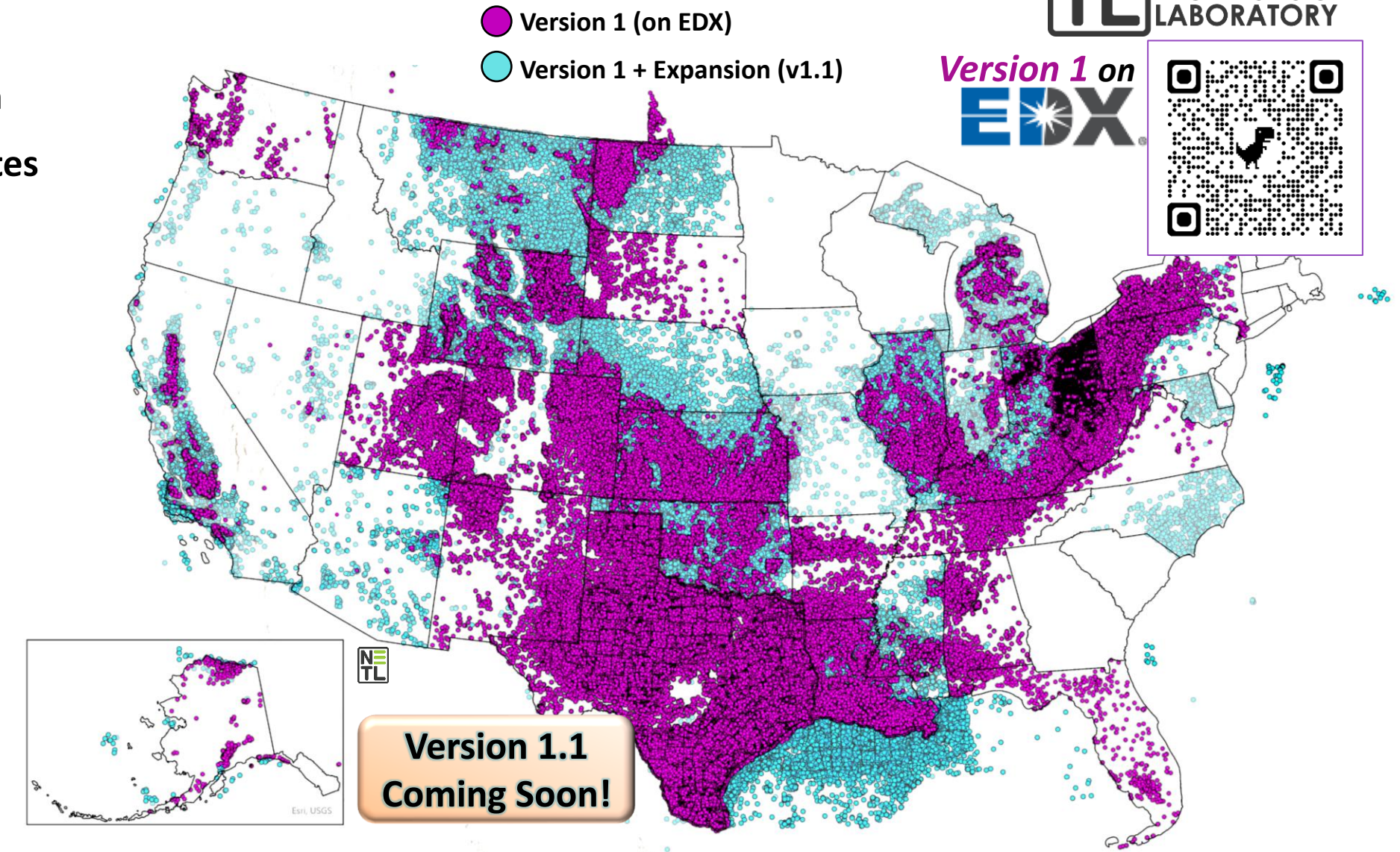
CO_2-Locate Database & Sharing

Accomplishments

- Significant data **expansion**
- Demonstrated **auto-updates**
- **Story map** & **application**

Presentations

- GSA 2023
  Geological Society of America
- AGU Fall Meeting 2023
  American Geophysical Union
- AAPG Orphan, Abandoned, Idle, and Marginal Wells Workshop 2024
  American Association of Petroleum Geologists
- CCUS 2024
  SPE AAPG SEG
- ESRI UC 2024
  Environmental Science Research Institute



Version 1 on EDX

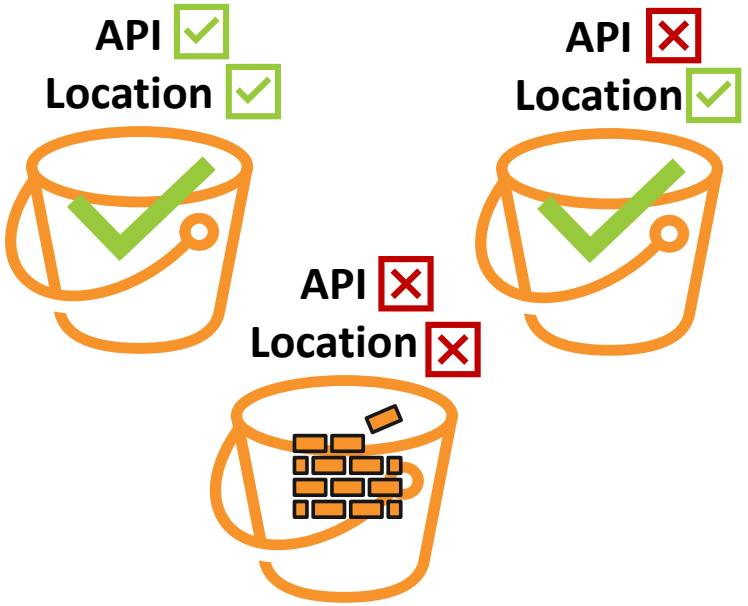
https://edx.netl.doe.gov/dataset/co2-locate

Enhancements: API & Redundancy Handling

Accomplishments & Ongoing Efforts

1. Creating Unique IDs (APIs)

- QAQC APIs on all records
  - State and county codes
- Creating APIs for older wells
  - Location & information available



2. Removing Redundancy

- Unique record per API
- Merging record attribute values
- Maintaining transparency

***Before* Redundancy Handling**

Attributes

Records

ID	Source	A	B	C
1st API	1	Value		Value
1st API	2		Value	
1st API	3	Value		

***After* Redundancy Handling**

ID	Sources	A	B	C
1st API	1,2,3	Value | Value	Value	Value
2nd API	1,2	Value	Value	
3rd API	1,2	Value	Value	

Flagging sources of values in ***metadata table***

ID	A	B	C
1st API	1, 3	2	1
2nd API	1	2	
3rd API	1	2	

Enhancements: Spatial Coverage Comparison

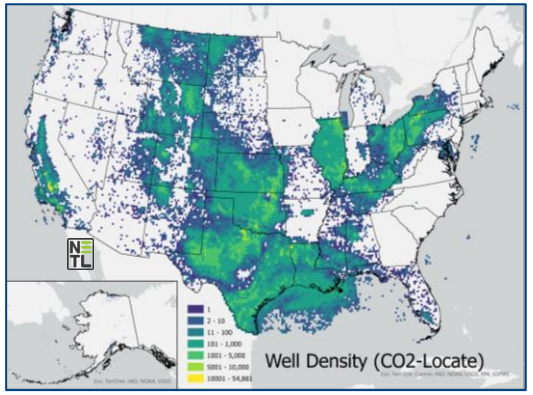
Accomplishments & Ongoing Efforts Continued

3. Gap Analysis -
Geospatial comparison by **footprint (A)** and **record density (B)**

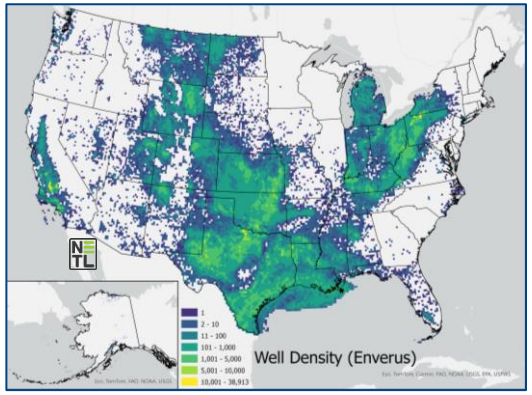
+15 million → ~5.2 million

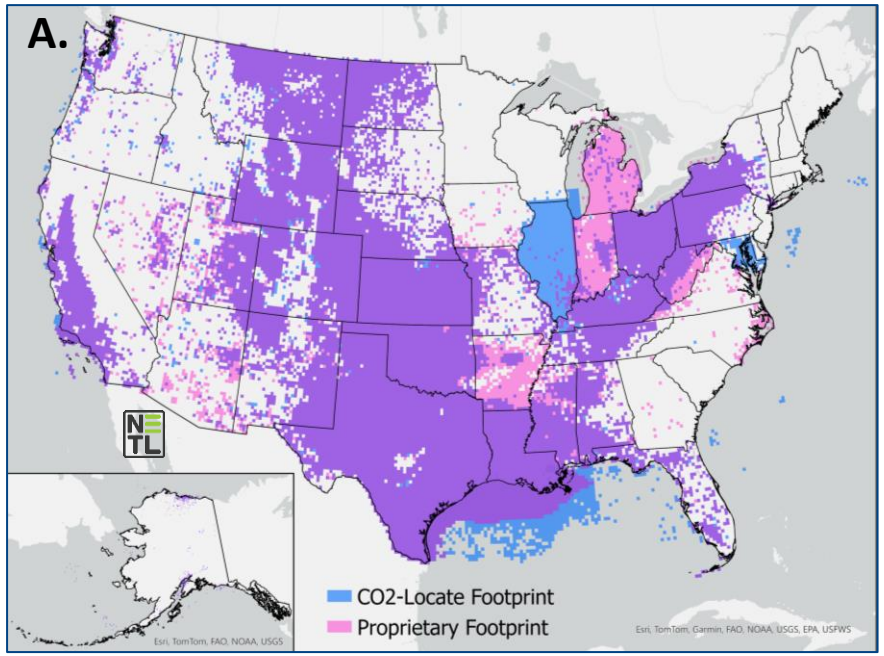
Preliminary test by unique API

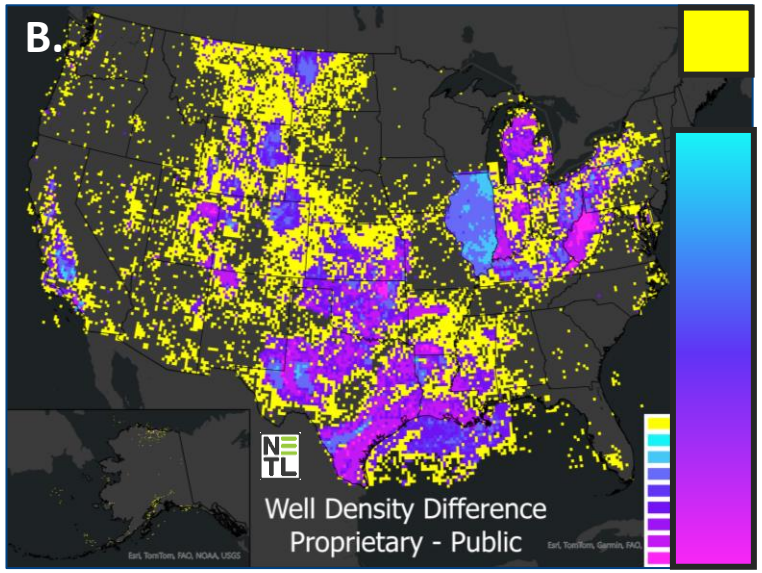
CO_2-Locate



Enverus (~5 million)







<=10 record difference

More public records

More proprietary records

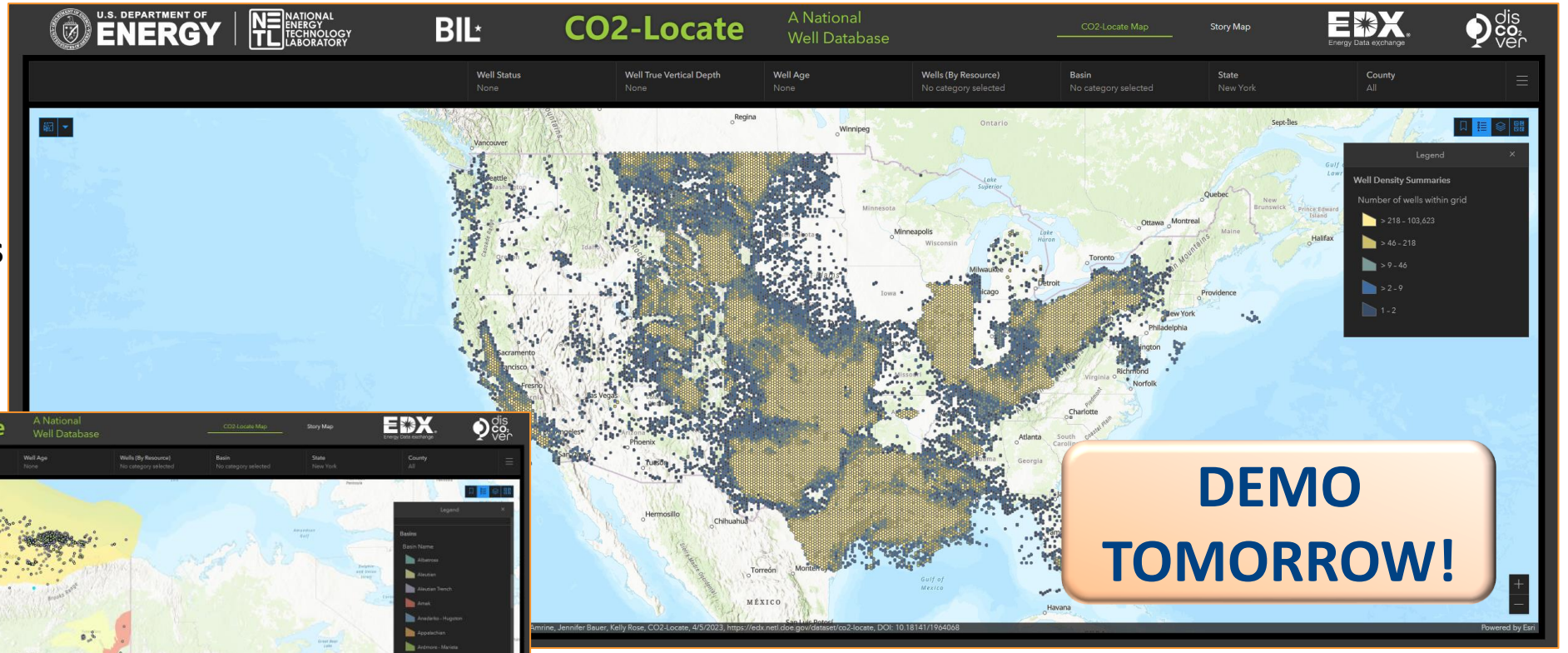
Initial Takeaways

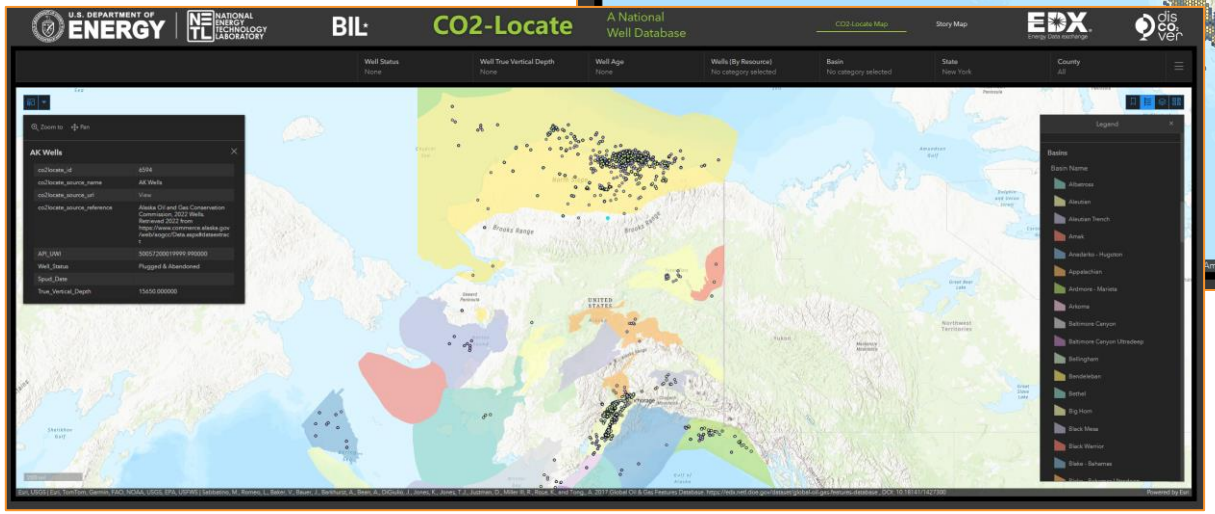
- Identified key state-specific gaps (MI, NC, GA)
- Promising preliminary results
- Further investigation needed following finalization of redundancy handling

CO_2-Locate Online Application

Providing Additional Data-Driven Insights

- Enables users to:
  - Apply **spatial or attribute filter**
  - **Access data**, **information**, and **links**
  - **Visualize data** trends and patterns





Anticipated release, Fall 2024

discover
Data Infrastructure to Accelerate CCS

Applications Utilizing CO_2-Locate

Building Off the Baseline

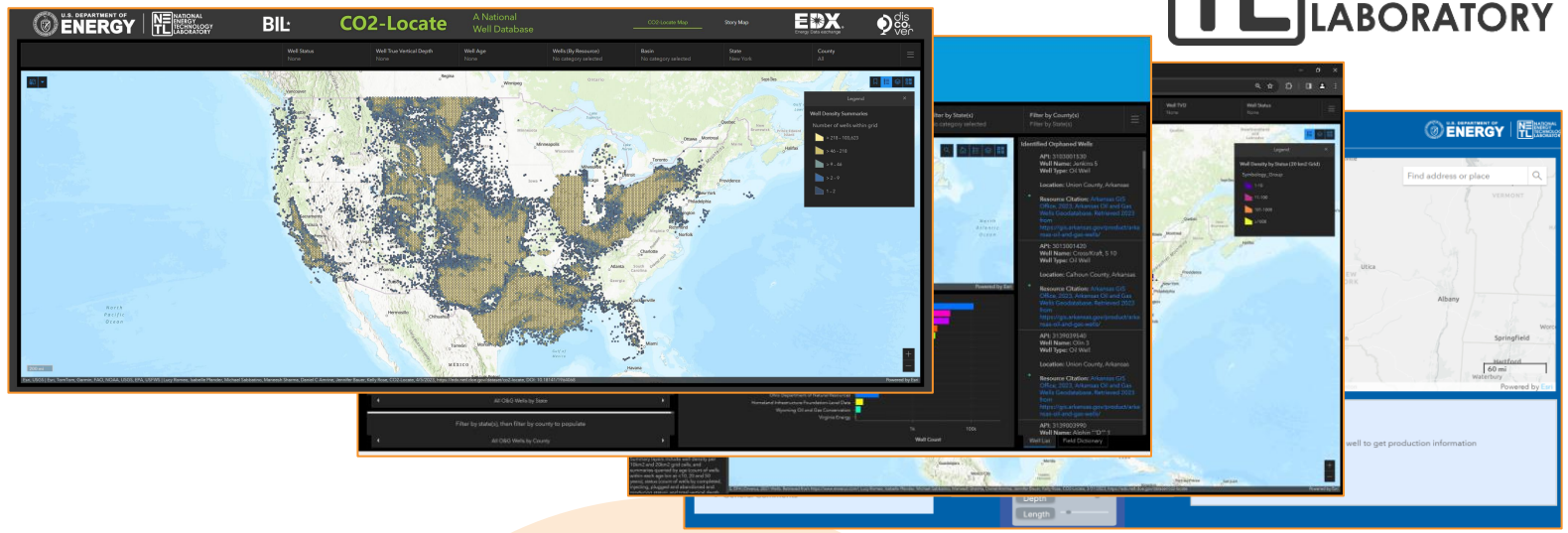
Data resources and **applications** developed to support:

- Carbon Transport and Storage
- Infrastructure identification & characterization
- Methane mitigation

Consortium Advancing Technology for Assessment of Lost Oil & Gas Wells.

Catalog & **attribute mapping schema** enables **easy changes** and **updates**:

- Mapping schema includes +1k **categorized attributes** (e.g., header, completion, production)
- Flagging marginal wells, orphaned wells



EWellID: *Energy Well Information Database*

Enterprise relational AWS Aurora database

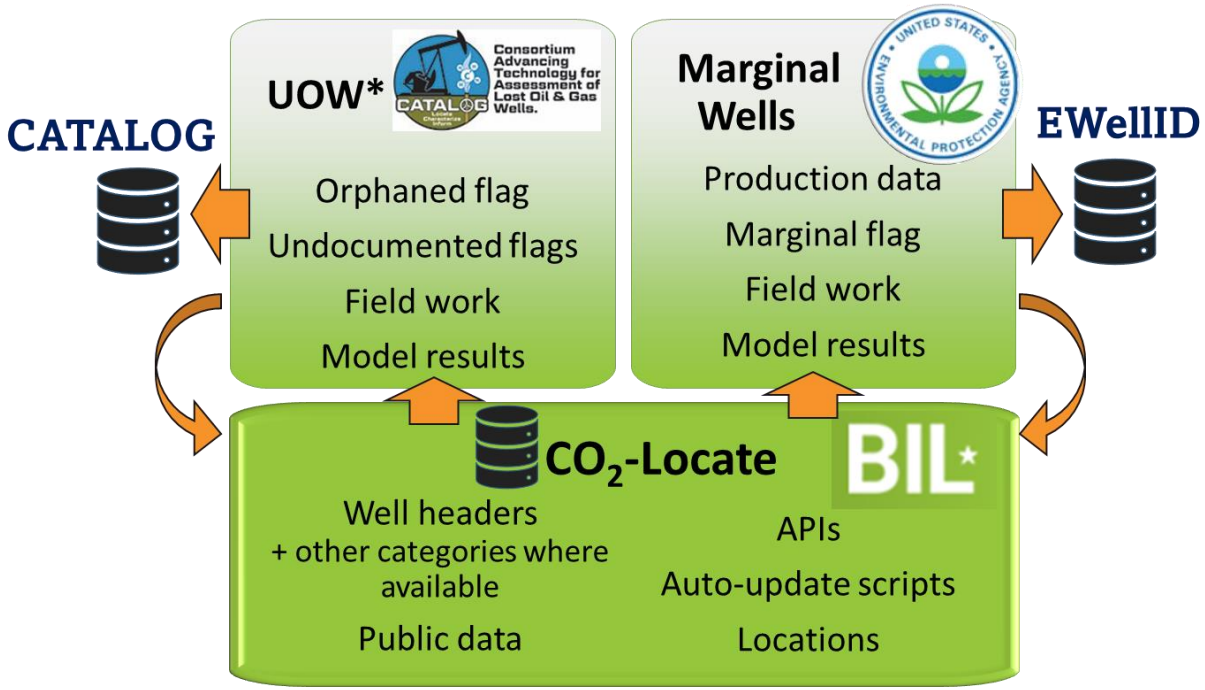
- Enable faster queries of data
- Structured & unstructured data
- Designed to grow
- Plugging in CO_2-Locate updates
- Levels of accessibility

+ well headers
+ production tables
+ well flags
+ mechanical integrity assessments
+ compliance reports
+ field work data
+ well integrity data

Increasing **Useability & Usefulness**

Lessons Learned

- **Stakeholder feedback**
- Plan for **scalability**
- **Identify & utilize cross-cutting projects**
- Applicable to building **federated resources**



*UOW - Undocumented and Orphaned Wells

Next Steps

- Finalize redundancy handling
- Further gap analytics & fill identified gaps
- Publication on method
- Upcoming GSA presentation
- Tentative AGU presentation

Release with enhancements,
Spring 2025

Values Delivered

- **Unified, up-to-date resource** with **direct links to original sources**
- **Standardized baseline** of **national, publicly available well resources**
- Designed to **deliver critical insights** to stakeholders **supporting permitting** and **safe operations**
- **FAIR** resource enables **cross-cutting quick wins**

the stats

54 RIC PRESENTATIONS	22 POSTERS	30 TOOL DEMOS

MONDAY

Presentations
(10:30AM - 5:25PM)

- 16 disCO2ver presentations

TUESDAY

Presentations
(10:30AM - 5:45PM)

- 17 SMART presentations
- 2 disCO2ver presentations
- 2 Geographic focus/tool presentations

Posters
(5:45PM - 7:45PM)

- 18 CTS Posters
- 2 PSCC Posters
- 1 CDR Poster
- 1 MLEF Poster

Tool Demos
(5:45PM - 7:45PM)

- 30 Tool Demos
  - SMART
  - NRAP
  - EDX
  - EDX4CCS

WEDNESDAY

Presentations
(2:10PM - 4:30PM)

- 3 transport, research, development, and demonstration activities presentations
- 1 transport modeling presentation
- 1 secure storage (basalts/mafic) presentation

THURSDAY

Presentations
(10:30AM - 5:20PM)

- 8 NRAP presentations
- 2 NETL RIC Presentations
- 2 Offshore presentations

NETL Research · Carbon Storage Program

NRAP National Risk Assessment Partnership

SMART

EDX disco2ver

https://edx.netl.doe.gov/disco2ver

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

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

Aug. 5-9, 2024 Pittsburgh Convention Center

Multiple tool demos will be hosted

Source: NETL

Acknowledgments

This work was performed in support of the U.S. Department of Energy's Fossil Energy and Carbon Management's Geo-Analysis and Monitoring Team and was developed jointly through the U.S. DOE Office of Fossil Energy and Carbon Management's EDX4CCS Project, in part, from the Bipartisan Infrastructure Law.

NETL RESOURCES

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