Ground Water Protection Council Annual Conference

June 22, 2022

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Great Plains Institute

Background on Great Plains Institute

An independent nongovernmental organization focused on energy policy and technology.

Mission

- *Transforming the energy system to benefit the economy and the environment.*

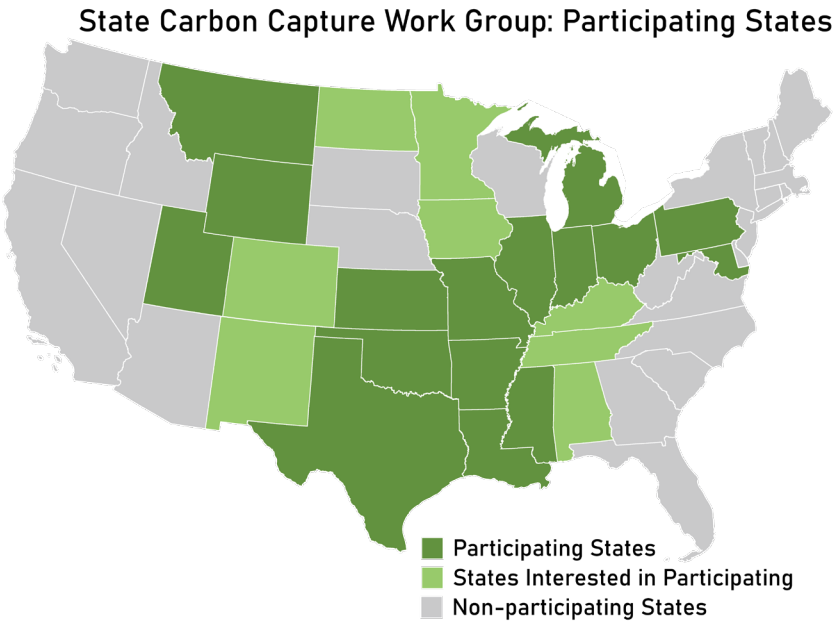
Objectives

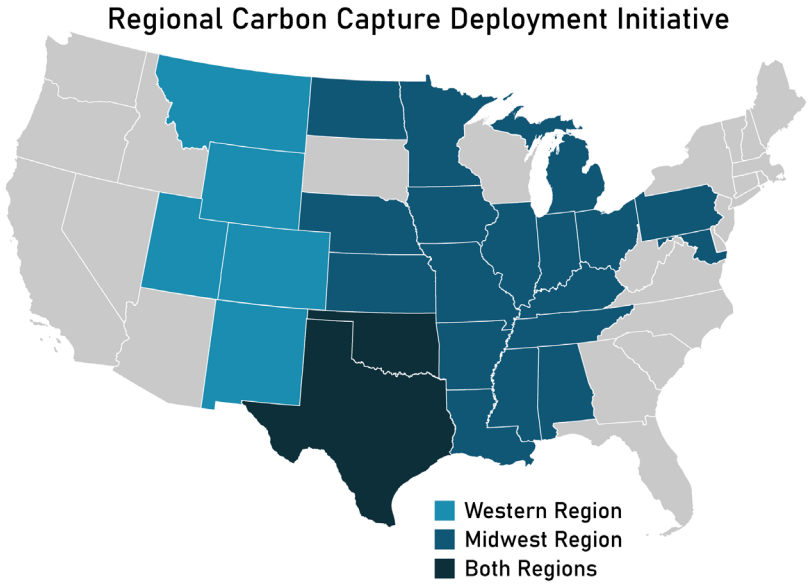
- *Increase energy efficiency and productivity.*
- *Decarbonize electricity production.*
- *Electrify the economy and adopt zero and low-carbon fuels.*
- *Capture carbon for beneficial use and permanent storage.*

Key GPI Carbon Management Objectives

- ***Elevate carbon capture as a national priority for achieving midcentury climate goals, creating high-wage jobs and sustaining our domestic energy and industrial base.***
- ***Provide comprehensive policy support for carbon capture equivalent to support already provided to other low and zero-emission technologies.***
- ***Foster economywide deployment of carbon capture and the national buildout of critical CO_2 pipeline infrastructure.***

Helping States Become Carbon Capture Ready



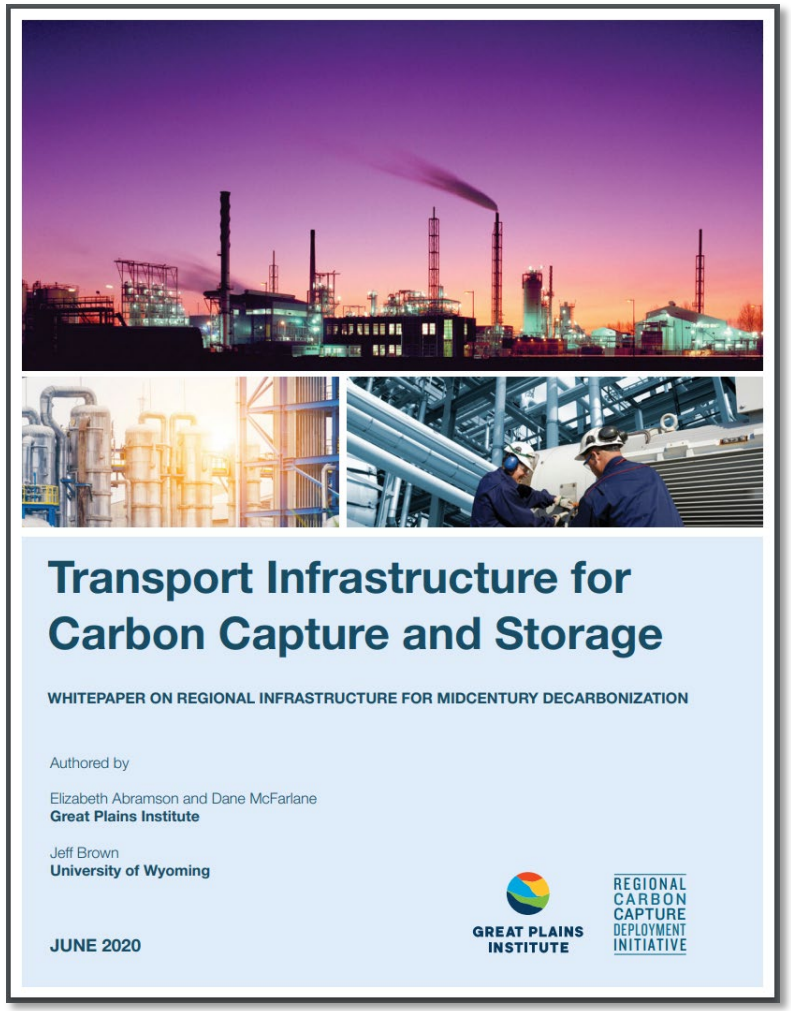


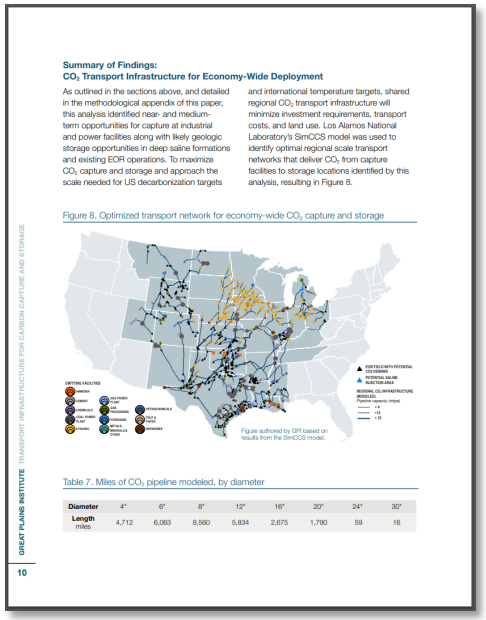
- **State Carbon Capture Work Group**: Established in 2015, with state officials representing 16 states.
- **Regional Deployment Initiative**: Approximately 700 state officials, companies, NGOs, and unions from over two dozen states interested in supporting state and federal policy development
- Work Group and RDI coordinating state policymaker and stakeholder engagement, development of policy recommendations, and regional deployment modeling and jobs analysis.

www.carboncaptureready.org

Analytical Report

Published June 30, 2020





Download the paper at:

carboncaptureready.org/analysis

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CO_2 Capture Opportunities: Industrial and Power Facilities

Section 45Q
Tax Credit for CO_2 Storage

Geologic Saline:	$50 / ton
EOR Storage:	$35 / ton

Minimum Capture Thresholds

Industrial Facility:	100 thousand tons CO_2
Power Plants:	500 thousand tons CO_2

Near- and Medium-Term Screening Criteria:

- 45Q Eligibility
- Operational patterns
- Expected life
- Right-size capture equipment to specific units within each facility

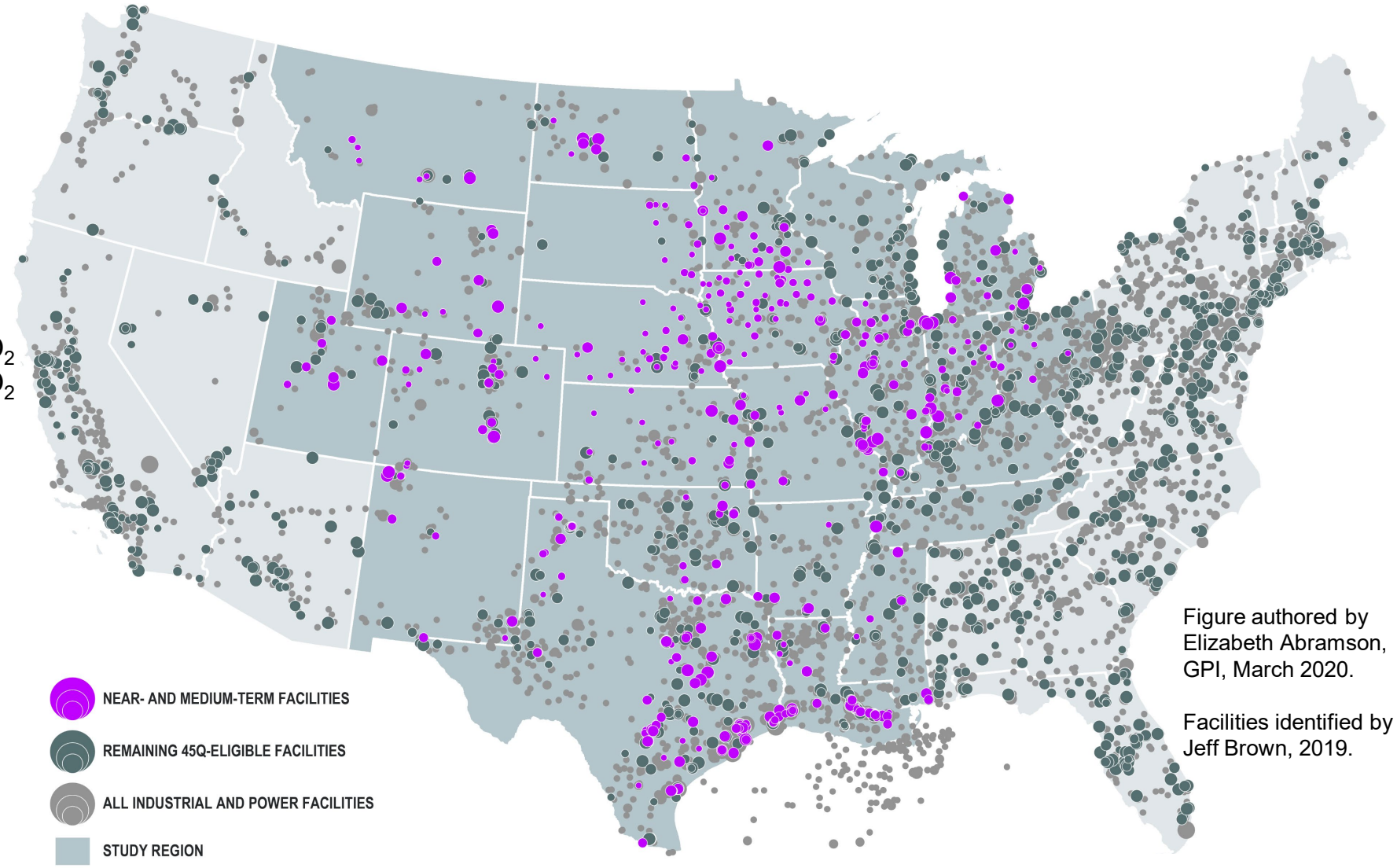

Figure authored by Elizabeth Abramson, GPI, March 2020.

Facilities identified by Jeff Brown, 2019.

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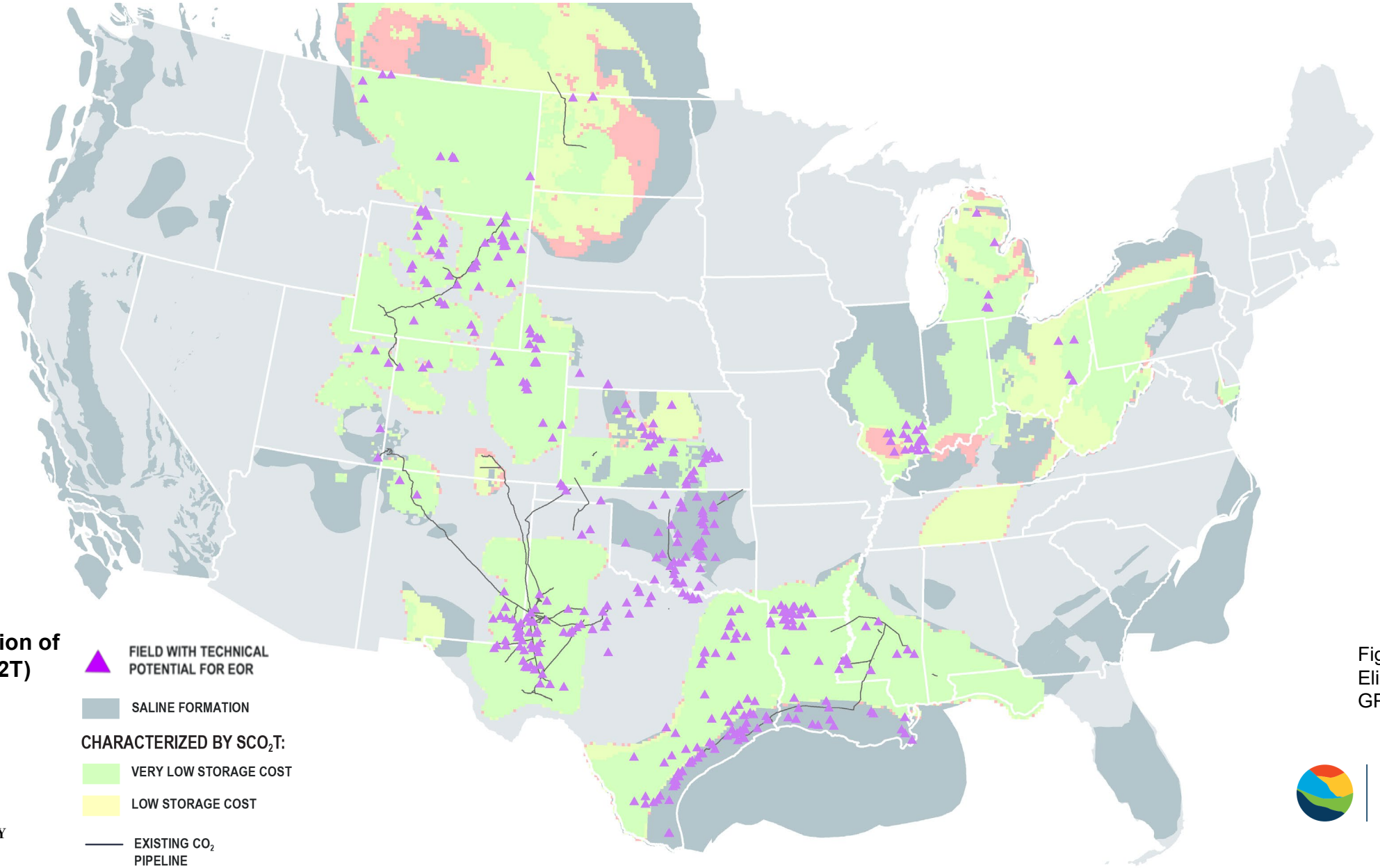
Saline: SCO2T & NATCARB 10km Grid Cells



Saline data via
The Sequestration of CO2 Tool (SCO2T)

Los Alamos NATIONAL LABORATORY EST. 1943

INDIANA UNIVERSITY

Figure authored by Elizabeth Abramson, GPI, March 2020

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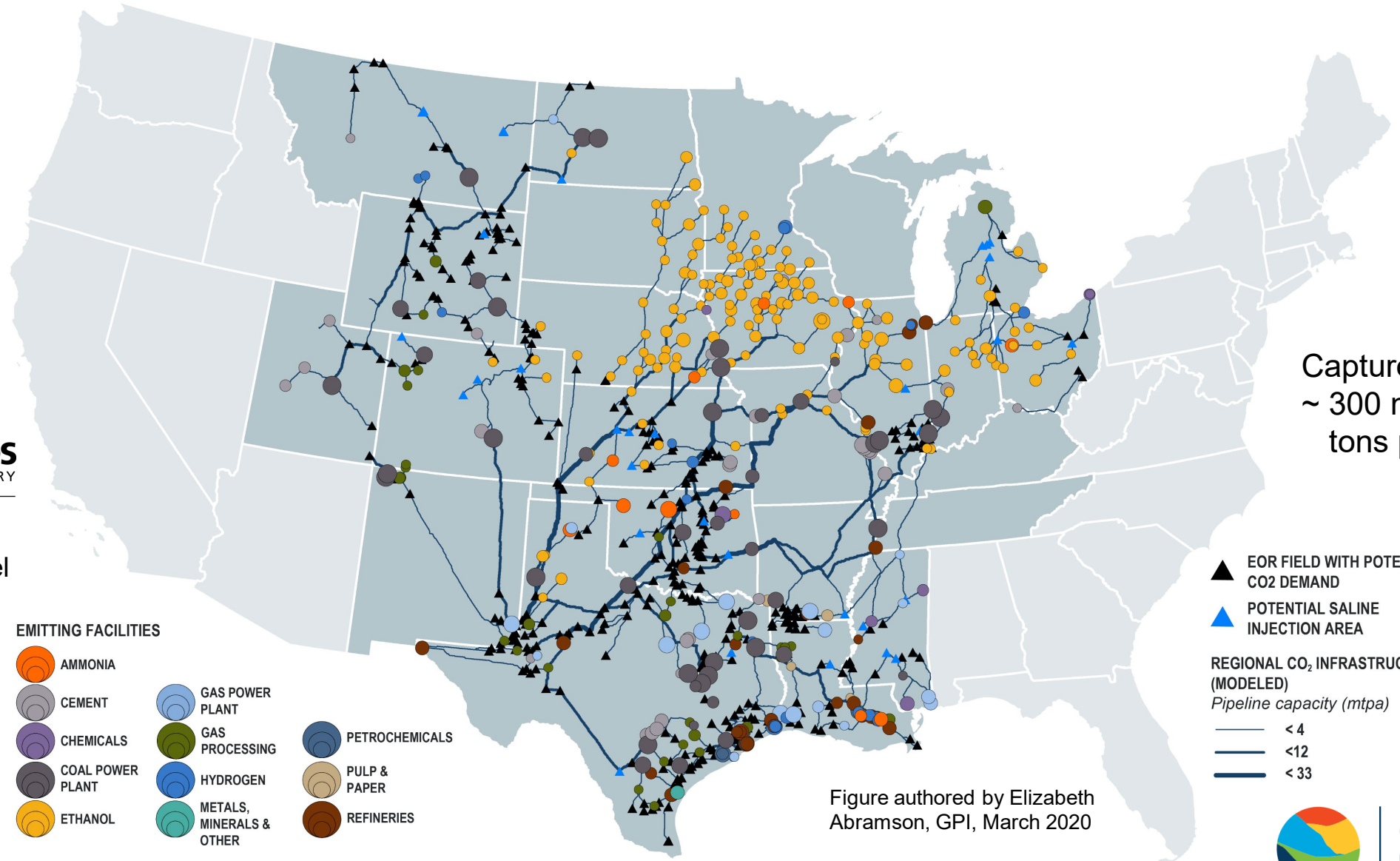
Near- and Medium-Term Scenario:
Optimized transport network for CO_2 capture and storage under 45Q



Los Alamos NATIONAL LABORATORY EST. 1943

SimCCS CO_2 transport model

Capture and storage: ~ 300 million metric tons per year

Figure authored by Elizabeth Abramson, GPI, March 2020

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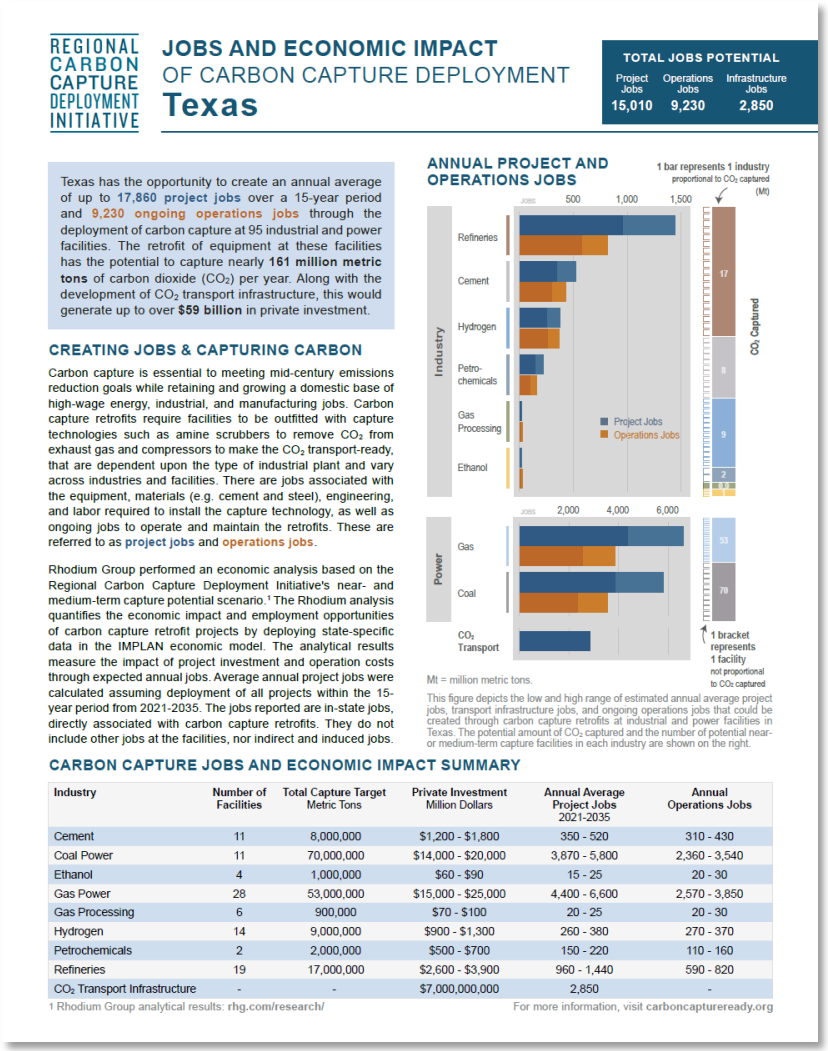
Carbon Capture Ready Website

RDI Homepage

- State fact sheets
- Jobs fact sheets
- Analytical white paper
- Policy briefs
- Resources on carbon capture

REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE



REGIONAL CARBON CAPTURE DEPLOYMENT INITIATIVE

JOBS AND ECONOMIC IMPACT OF CARBON CAPTURE DEPLOYMENT
Texas

TOTAL JOBS POTENTIAL

Project Jobs	Operations Jobs	Infrastructure Jobs
15,010	9,230	2,850

Texas has the opportunity to create an annual average of up to **17,860 project jobs** over a 15-year period and **9,230 ongoing operations jobs** through the deployment of carbon capture at 95 industrial and power facilities. The retrofit of equipment at these facilities has the potential to capture nearly **161 million metric tons** of carbon dioxide (CO_2) per year. Along with the development of CO_2 transport infrastructure, this would generate up to over **$59 billion** in private investment.

CREATING JOBS & CAPTURING CARBON

Carbon capture is essential to meeting mid-century emissions reduction goals while retaining and growing a domestic base of high-wage energy, industrial, and manufacturing jobs. Carbon capture retrofits require facilities to be outfitted with capture technologies such as amine scrubbers to remove CO_2 from exhaust gas and compressors to make the CO_2 transport-ready, that are dependent upon the type of industrial plant and vary across industries and facilities. There are jobs associated with the equipment, materials (e.g. cement and steel), engineering, and labor required to install the capture technology, as well as ongoing jobs to operate and maintain the retrofits. These are referred to as **project jobs** and **operations jobs**.

Rhodium Group performed an economic analysis based on the Regional Carbon Capture Deployment Initiative's near- and medium-term capture potential scenario.[1] The Rhodium analysis quantifies the economic impact and employment opportunities of carbon capture retrofit projects by deploying state-specific data in the IMPLAN economic model. The analytical results measure the impact of project investment and operation costs through expected annual jobs. Average annual project jobs were calculated assuming deployment of all projects within the 15-year period from 2021-2035. The jobs reported are in-state jobs, directly associated with carbon capture retrofits. They do not include other jobs at the facilities, nor indirect and induced jobs.

ANNUAL PROJECT AND OPERATIONS JOBS

Mt = million metric tons.

This figure depicts the low and high range of estimated annual average project jobs, transport infrastructure jobs, and ongoing operations jobs that could be created through carbon capture retrofits at industrial and power facilities in Texas. The potential amount of CO_2 captured and the number of potential near- or medium-term capture facilities in each industry are shown on the right.

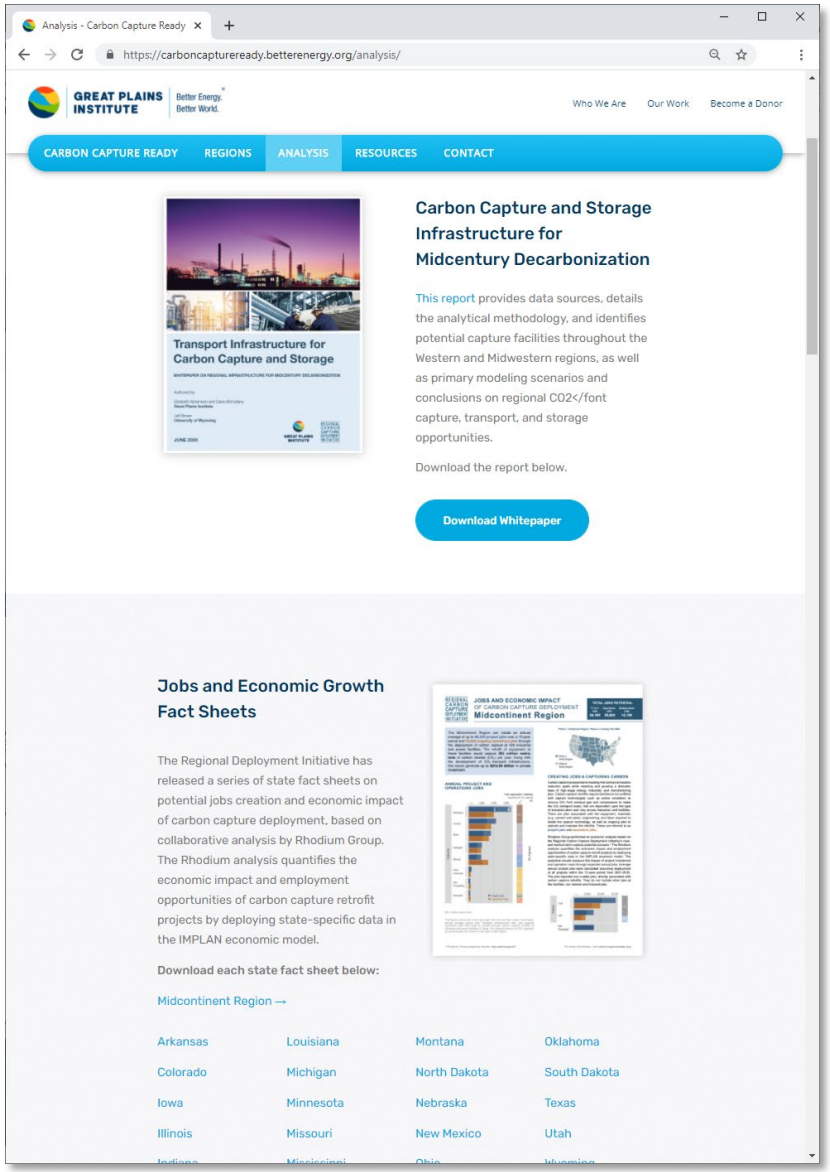
CARBON CAPTURE JOBS AND ECONOMIC IMPACT SUMMARY

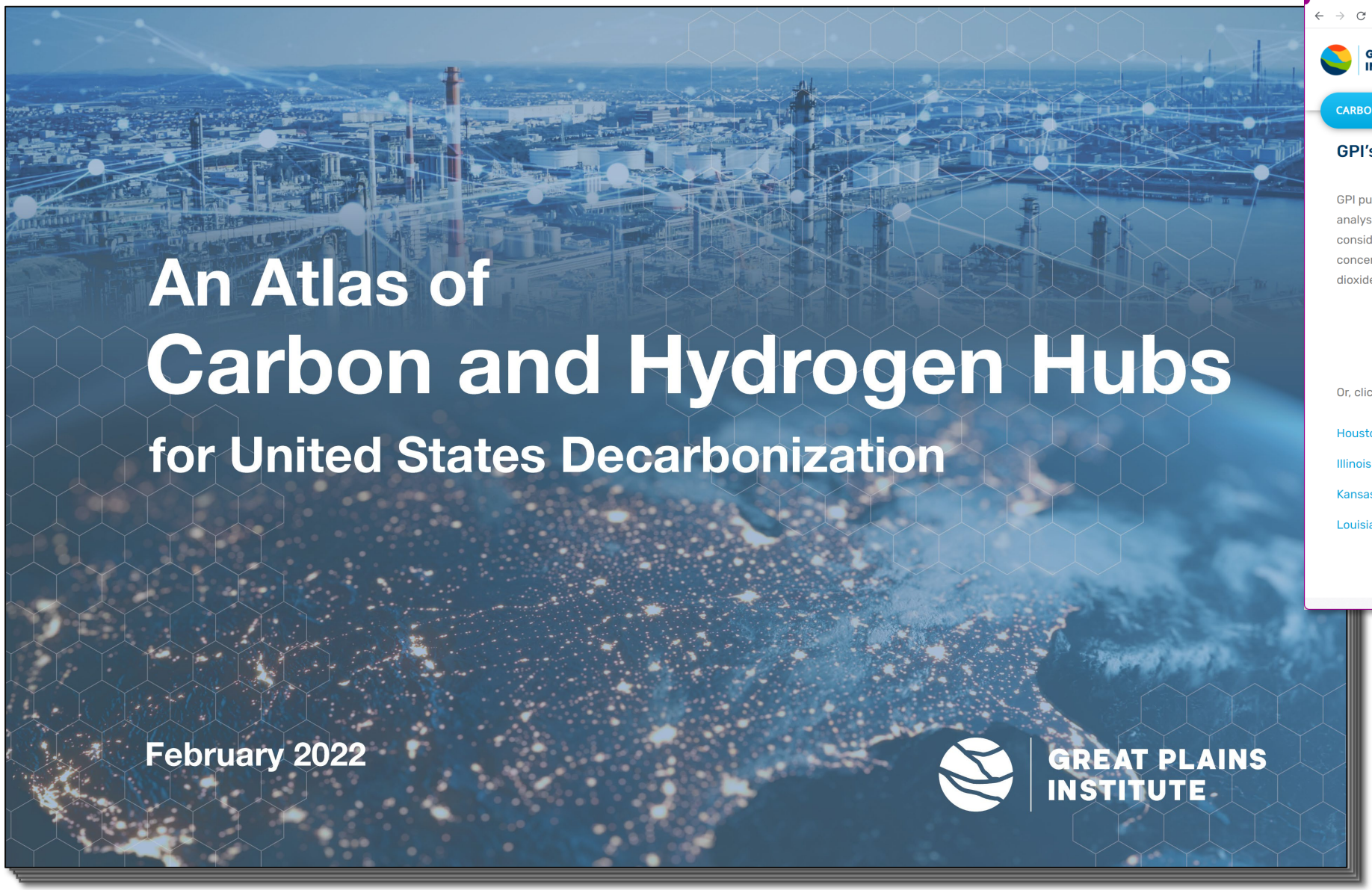
Industry	Number of Facilities	Total Capture Target Metric Tons	Private Investment Million Dollars	Annual Average Project Jobs 2021-2035	Annual Operations Jobs
Cement	11	8,000,000	$1,200 - $1,800	350 - 520	310 - 430
Coal Power	11	70,000,000	$14,000 - $20,000	3,870 - 5,800	2,360 - 3,540
Ethanol	4	1,000,000	$60 - $90	15 - 25	20 - 30
Gas Power	28	53,000,000	$15,000 - $25,000	4,400 - 6,600	2,570 - 3,850
Gas Processing	6	900,000	$70 - $100	20 - 25	20 - 30
Hydrogen	14	9,000,000	$900 - $1,300	260 - 380	270 - 370
Petrochemicals	2	2,000,000	$500 - $700	150 - 220	110 - 160
Refineries	19	17,000,000	$2,600 - $3,900	960 - 1,440	590 - 820
CO_2 Transport Infrastructure	-	-	$7,000,000,000	2,850	-

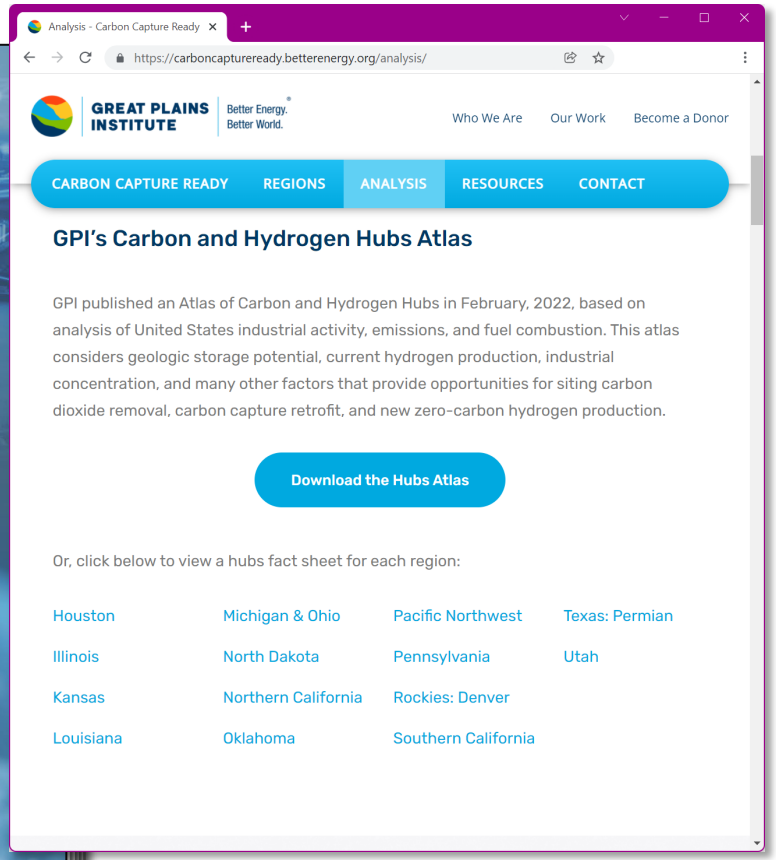
1 Rhodium Group analytical results: rhg.com/research/

For more information, visit carboncaptureready.org

carboncaptureready.org







Download the atlas at:
carboncaptureready.org

Potential US Carbon and Hydrogen Hubs

Guiding Criteria

- High concentration of large industrial emitters
- High quantities of fossil fuel use for on-site industrial energy production
- Presence of 45Q tax credit qualifying facilities for carbon capture retrofit, as well as identified near- and medium-term capture opportunities
- Current reported production of hydrogen and ammonia (optional)
- Large geologic saline and fossil formations for permanent CO2 storage
- Existing multi-modal commodity distribution infrastructure such as freight railroads, barge waterways and ports, and freight truck interstate highway routes
- Existing conventional fossil fuel distribution infrastructure for hydrogen blending and established right-of-way that minimizes impact of CO2 transport infrastructure

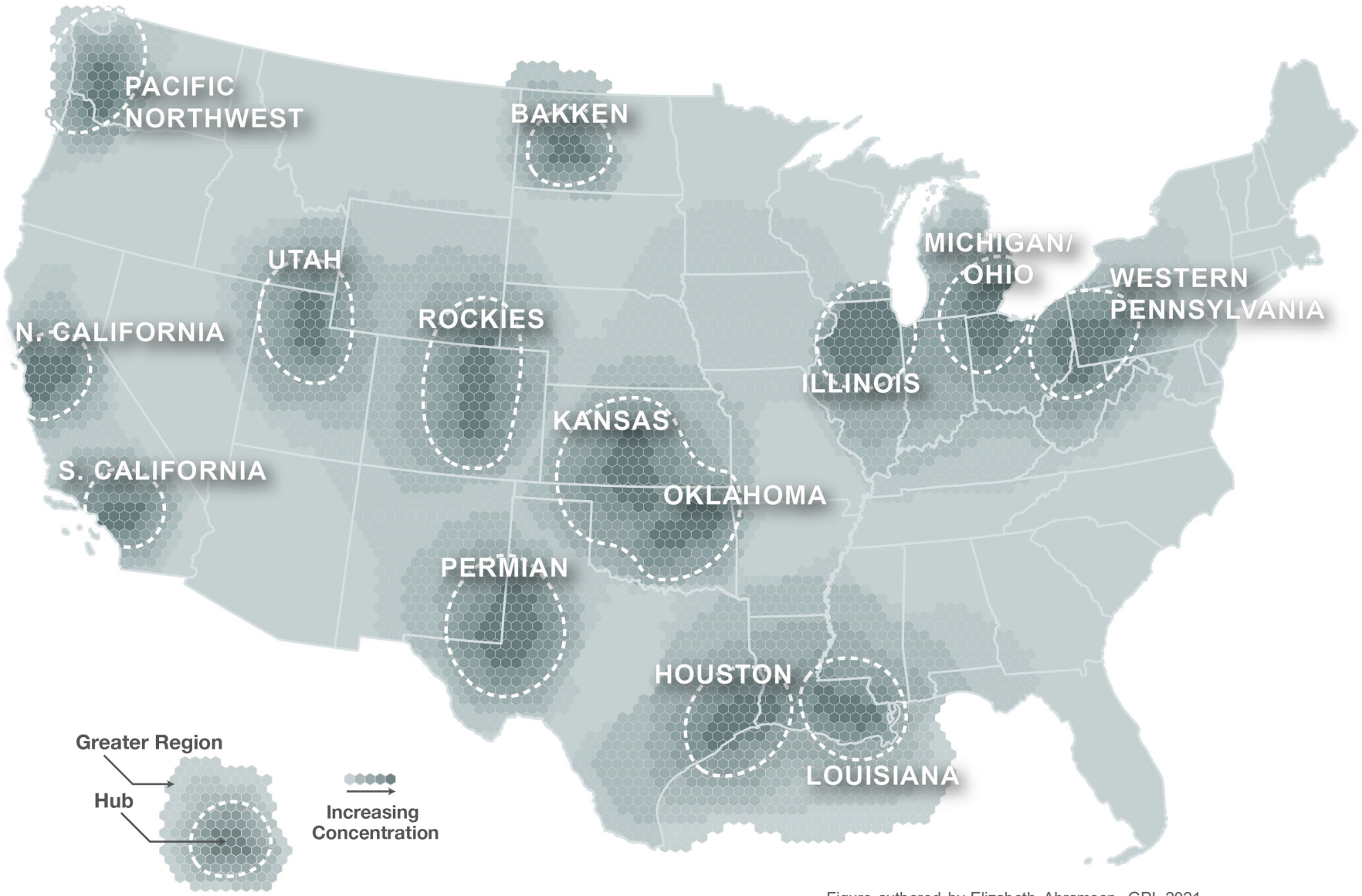


Figure authored by Elizabeth Abramson, GPI, 2021
Source: Carbon and Hydrogen Hubs Atlas, GPI 2022

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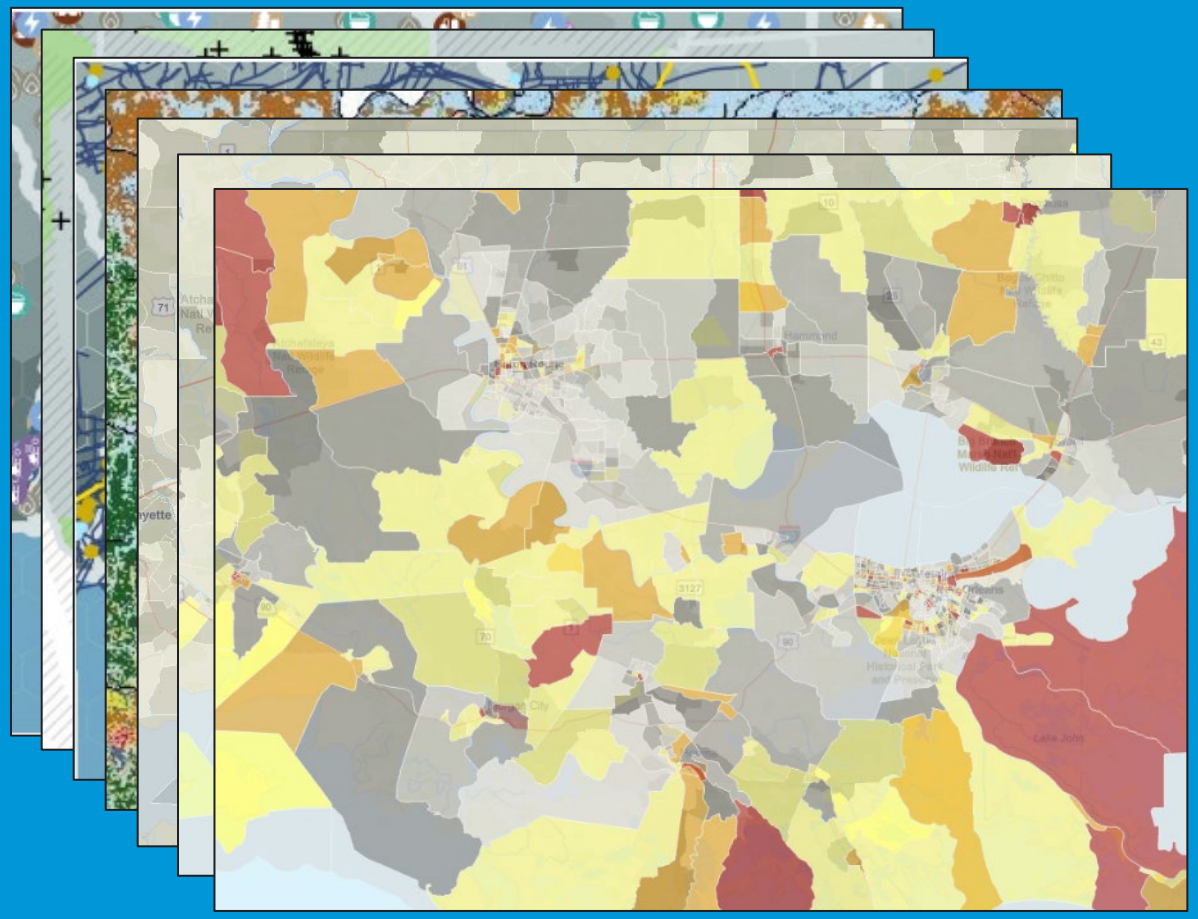
Decision Support Tool

- Geospatial Analysis
- Environmental, Natural Resource, Legal Constraints
- Environmental Justice
  - Demographic Data
  - Stakeholder Engagement

TOOL ARCHITECTURE



Infrastructure

+ Environmental

+ EJ/Community =

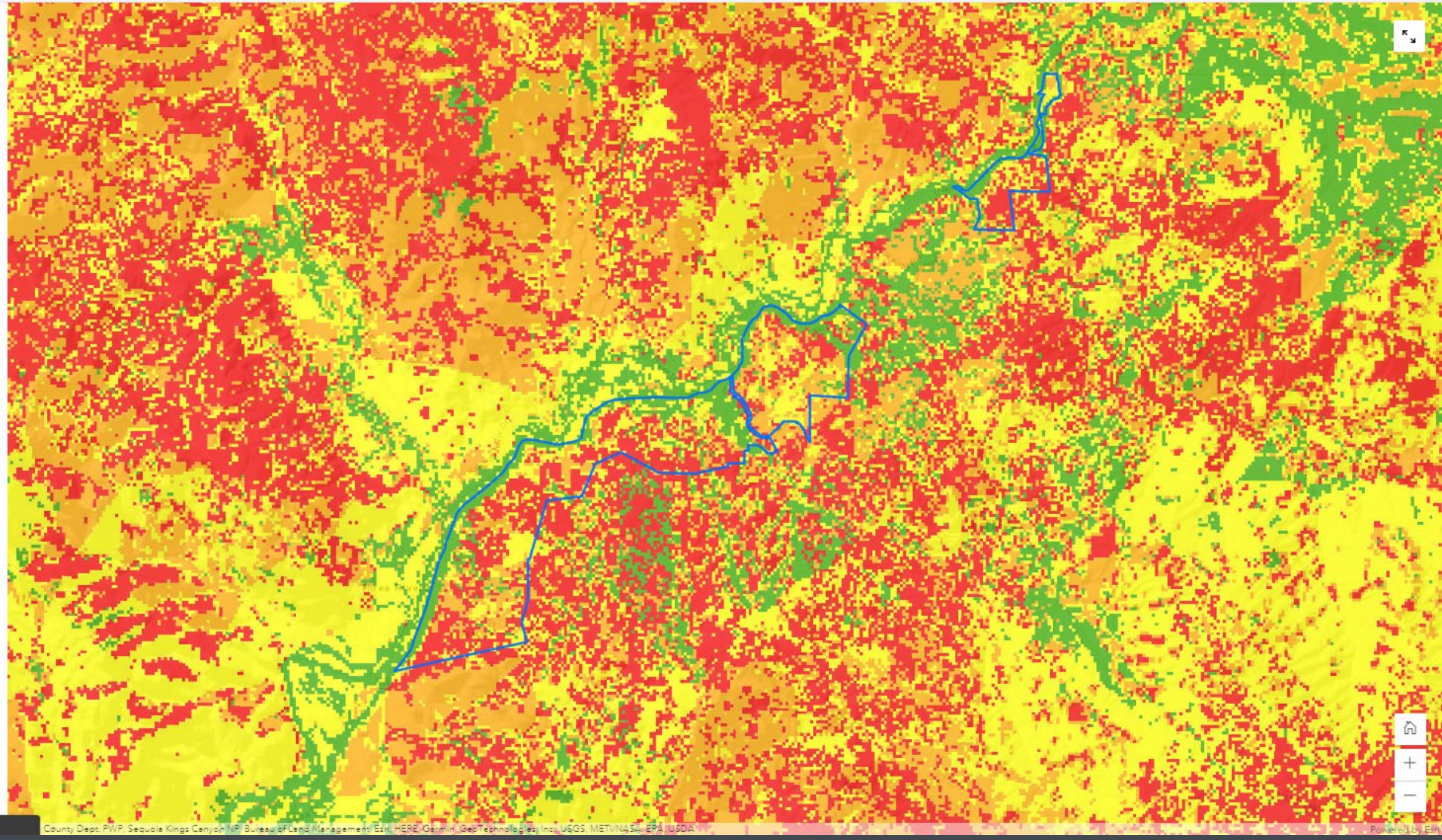
TOOL TO SUPPORT STAKEHOLDER OUTREACH AND ENGAGEMENT

Main Corridor - South

RISK RATING 101

POSITIVE	NEGATIVE
✓ Visible and reflective street signs	✗ Ingress/egress: one major road, steep and narrow
✓ Low previous fire occurrence	✗ Limited turnarounds
✓ Nearby fire station	✗ Heavy fuel loading
✓ Road conditions: short driveways	✗ Defensible space: limited, small lots
	✗ Building construction: mixed, largely combustible
	✗ Limited water sources
	✗ Utility placement: propane and electric are aboveground
	✗ Problematic topography
	✗ Roofing materials: vary widely

RECOMMENDATIONS



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SWCA

- *STATE DRIVERS*
  - *Supportive Statutory Framework*
  - *Financial Incentives*
  - *Siting Assistance*

Supportive Statutory Framework

- *Pore Space Ownership*
- *CO_2 Ownership*
- *Unitization/Amalgamation*
- *Stewardship Requirements*
- *Regulatory Regime and Appropriations*

Financial Incentives

- *Reduced Royalties/Severance*
- *Sales Tax Waivers*
- *Reduced Property Taxes*
- *Loans and Grants*

Siting Assistance

- *Pipeline Siting*
- *Geologic Characterization*
- *Public Outreach*

Thank You

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