



2023 Snapshot: Advancements in Equity and Environmental Justice and Potential Implications

Presented by Jessi Eidbo, AICP | Carbon Solutions
CUSP Annual Meeting | 20 June 2023 | Lawrence, KS

Carbon Solutions

ABOUT US.

Mission-driven business

CARBON SOLUTIONS works with industry, government, non-profits, researchers, & other stakeholders to identify & implement real-world solutions for low-carbon energy challenges.

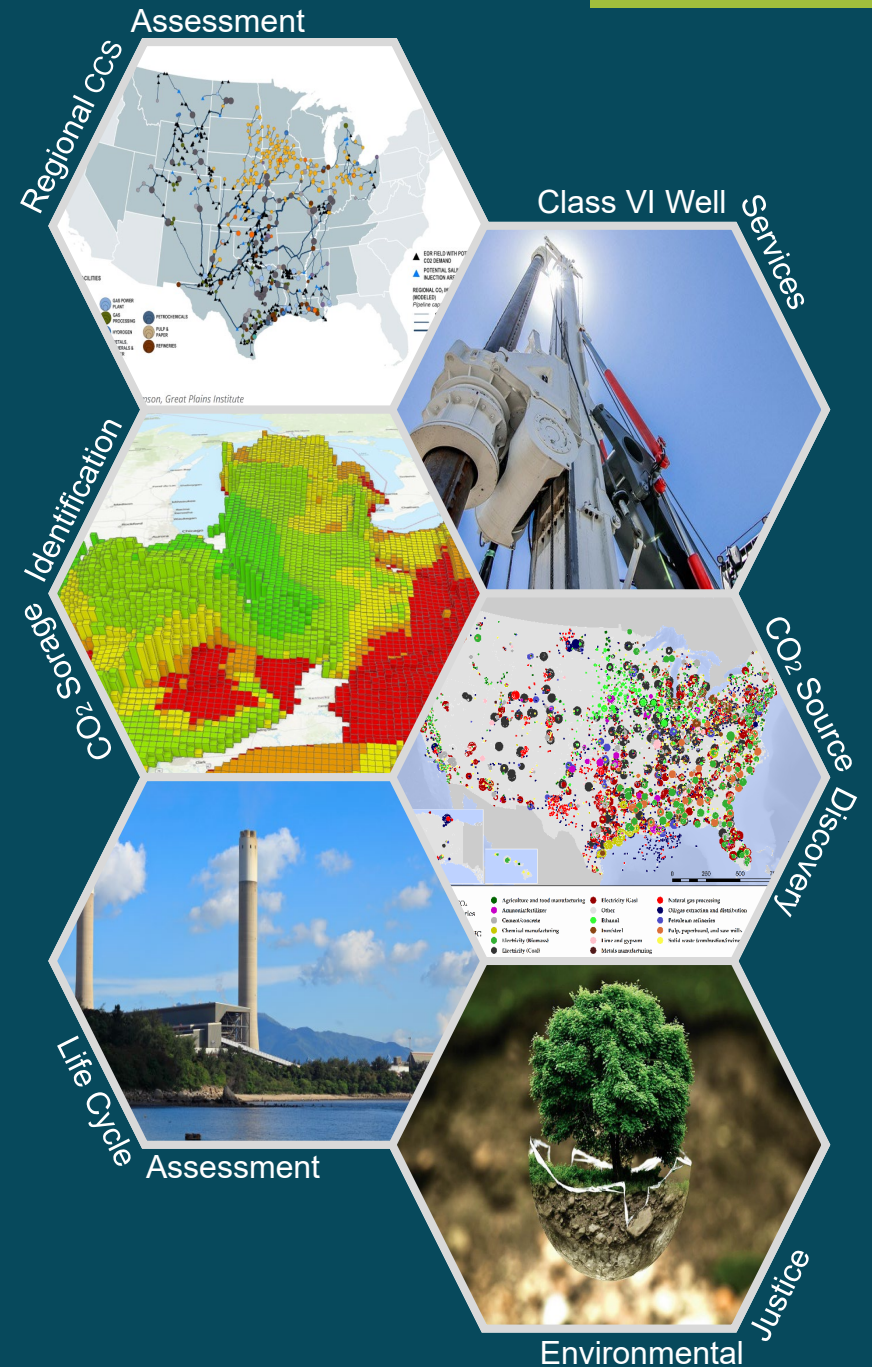
HISTORY: Launched in 2021 | 27 employees (12 PhD's)
FUNDING: 60% Fed. | 25% NGOs | 15% Industry.
FOUNDATION: Development of *SimCCS* and complementary software suite for system optimization.

Energy applications

CO₂ capture-transport-utilization-storage, hydrogen, direct air capture, geothermal, wind, energy storage, grid modeling, electric vehicles, energy equity, stakeholder facilitation, planning and siting.

Data analytics

Optimization, reservoir simulation, ML/AI, LCA, TEA, econometrics, GIScience, and more.





TODAY'S AGENDA.

- I. CCUS Imperative
- II. Some Key Definitions
- III. A Brief History Lesson
- IV. Application Today!
- V. Next Steps and Beyond



I. Why CCUS?



A minimum 0.9 GtCO₂/yr of CO₂ sequestration is required to transition the economy to net-zero by 2050.

-Princeton Net Zero America Study (Dr. Eric Larson, Andlinger Center for Energy + Environment)

That's a truly giant number.





That's a truly giant number.



= 199 tonnes

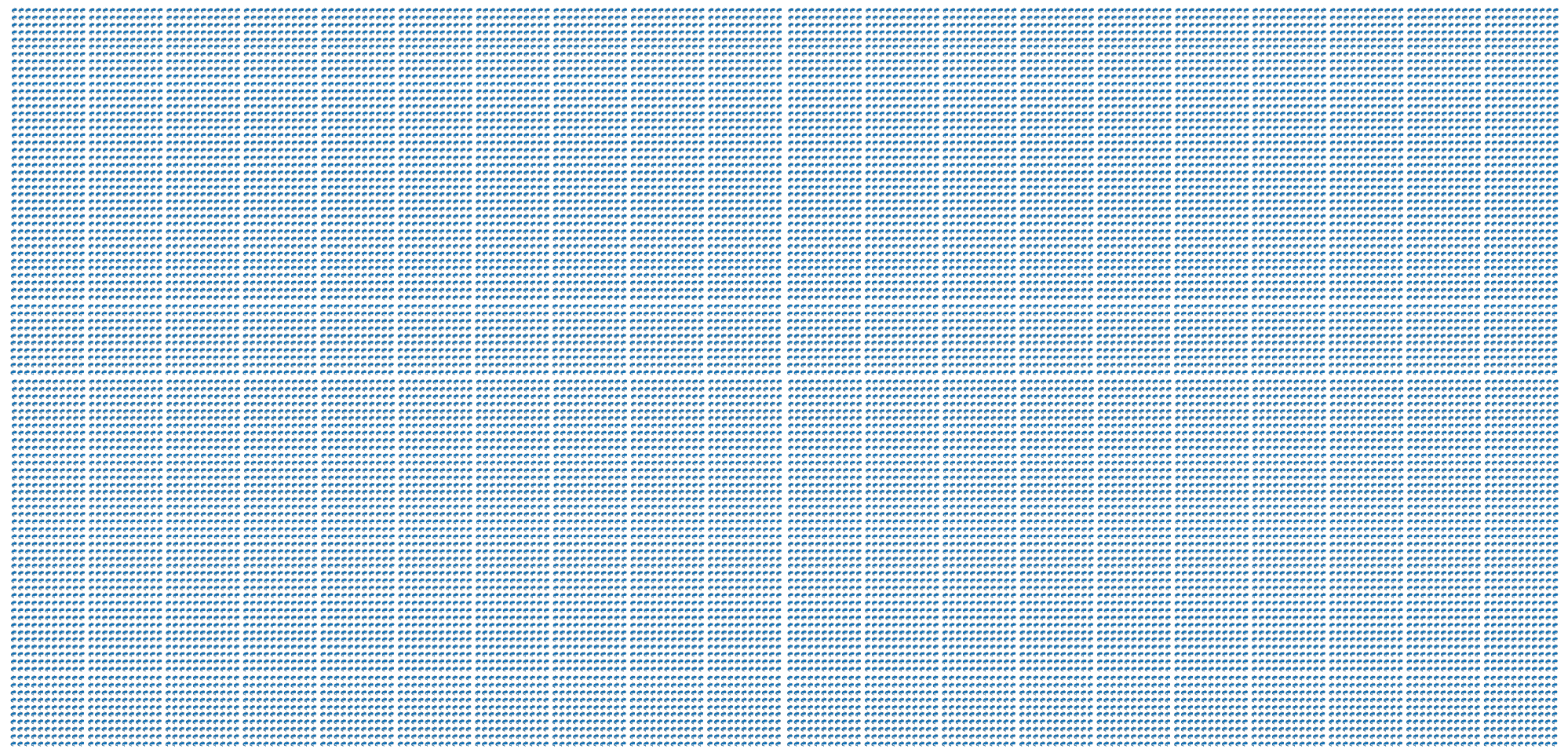


That's a truly giant number.

 = 199 tonnes



=

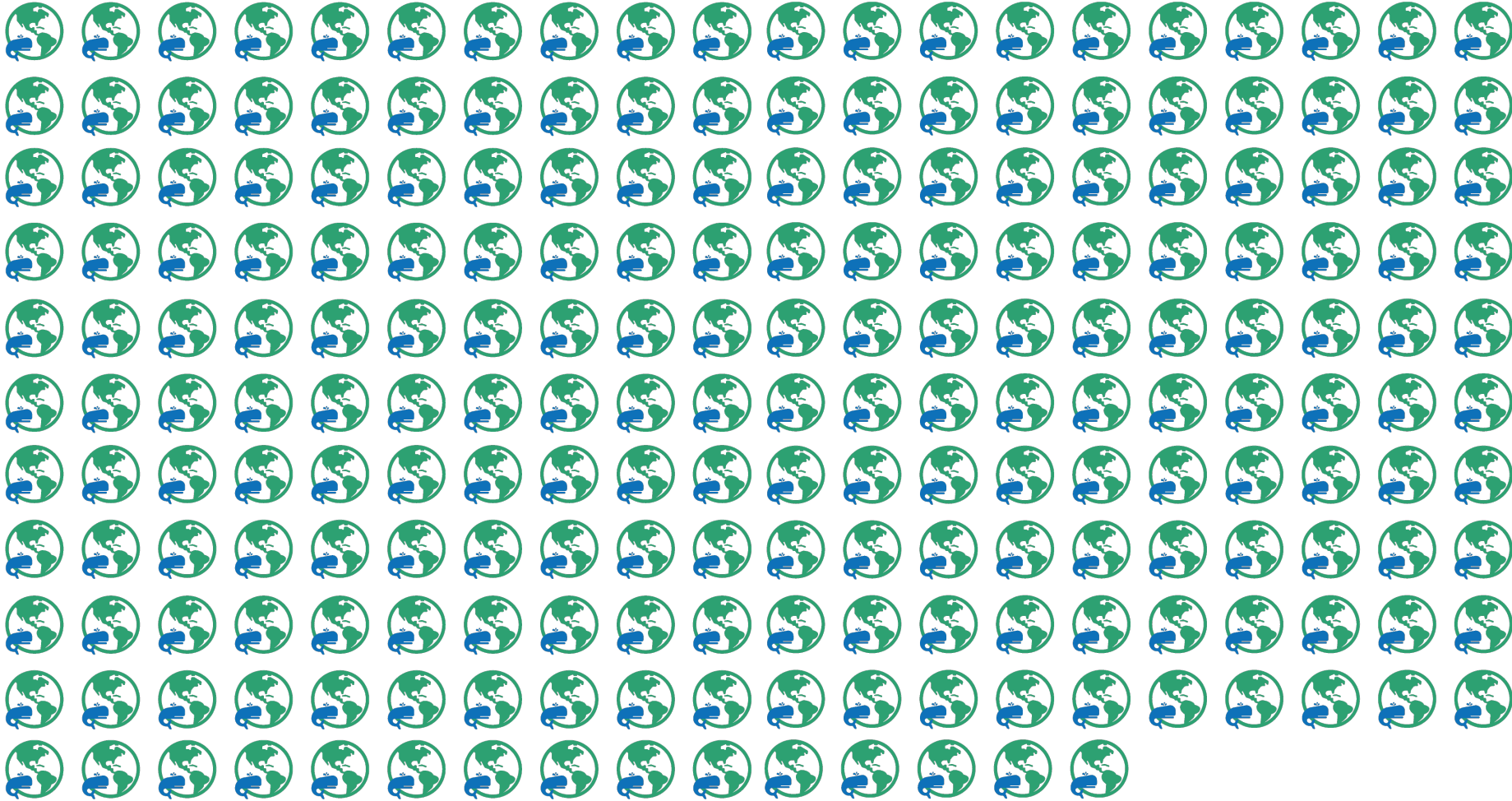




That's a truly giant number.

Carbon Solutions

0.9 gigatonnes =



216 Earth-equivalencies of all (optimistically estimated) blue whale mass



A minimum 0.9 GtCO₂/yr of CO₂ sequestration is required to transition the economy to net-zero by 2050.

-Princeton Net Zero America Study (Dr. Eric Larson, Andlinger Center for Energy + Environment)

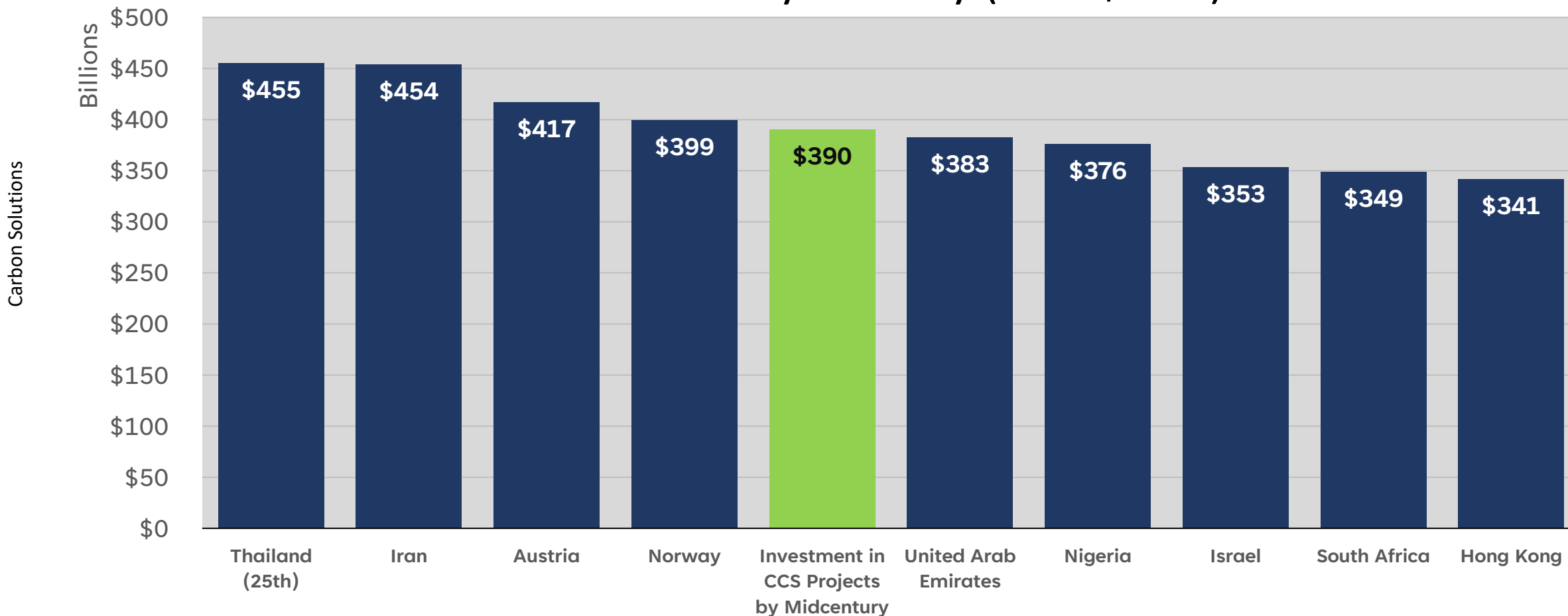
There will be an **\$330–500 billion** invested in CCS projects in the US by midcentury.

-The Rhodium Group, 2022 CCUS Analysis



That's also a lot of money.

Nominal GDP by Country (2017\$USD)





Three True Things in CCUS

1. We will be deploying CCS, along with other decarbonization and carbon management technologies, at a pace of investment high not seen since the Roosevelt Administration.



Three True Things in CCUS

1. We will be deploying CCS, along with other decarbonization and carbon management technologies, at a pace of investment high not seen since the Roosevelt Administration.
2. Most people still do not really know what CCS is, nor why we would need or want it.



Three True Things in CCUS

1. We will be deploying CCS, along with other decarbonization and carbon management technologies, at a pace of investment high not seen since the Roosevelt Administration.
2. Most people still do not really know what CCS is, nor why we would need or want it.
3. The enormous risk of initial project development going “wrong” – for a myriad of reasons - could stymie future deployment.



How does Environmental Justice fit in?



II. Glossary and Definitions



Environmental Justice

according to DOE

Environmental justice is the **fair treatment** and **meaningful involvement** of all people, regardless of race, color, national origin, or income, with respect to the **development, implementation, and enforcement of environmental laws, regulations, and policies.**



Four Types of Justice

- ✓ Distributive Justice (i.e., economic justice) = distribution of goods



Four Types of Justice

- ✓ Distributive Justice (i.e., economic justice) = distribution of goods
- ✓ Procedural Justice = fair treatment based on actions



Four Types of Justice

- ✓ Distributive Justice (i.e., economic justice) = distribution of goods
- ✓ Procedural Justice = fair treatment based on actions
- ✓ Retributive Justice = treat others as you are treated



Four Types of Justice

- ✓ Distributive Justice (i.e., economic justice) = distribution of goods
- ✓ Procedural Justice = fair treatment based on actions
- ✓ Retributive Justice = treat others as you are treated
- ✓ Restorative Justice = compensate for the damage committed against them by restoring well-being and tranquility, to some extent, to specific individuals



Four Types of Justice

- ✓ Distributive Justice (i.e., economic justice) = distribution of goods
- ✓ Procedural Justice = fair treatment based on actions
- ✓ Retributive Justice = treat others as you are treated
- ✓ Restorative Justice = compensate for the damage committed against them by restoring well-being and tranquility, to some extent, to specific individuals

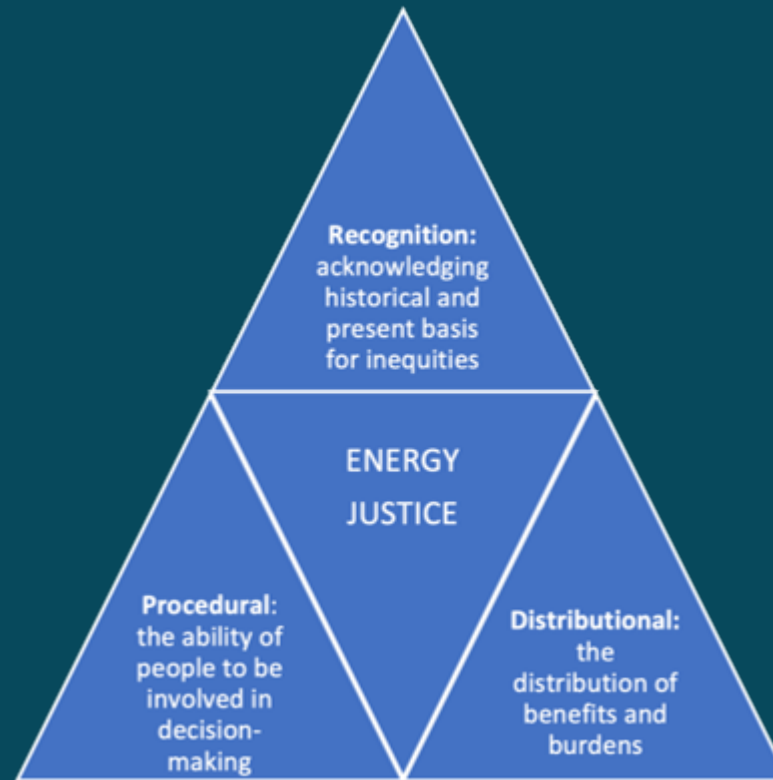


Four Types of Justice

- ✓ Distributive Justice (i.e., economic justice) = distribution of goods
- ✓ Procedural Justice = fair treatment based on actions
- ✓ Retributive Justice = treat others as you are treated
- ✓ Restorative Justice = compensate for the damage committed against them by restoring well-being and tranquility, to some extent, to specific individuals



Energy Justice



Carley, S., Konisky, D. M. The Justice and Equity Implications of the Clean Energy Transition. *Nature Energy* 2020 5:8 2020, 5 (8), 569-577. 10.1038/s41560-020-0641-6



Jemez Principles for Democratic Organizing

Established with the intention of hammering out common understandings between participants from different cultures, politics and organizations

RELEVANCE?

- Adopted by much of the environmental justice movement
- Frames grounding foundation to establish norms for meeting and empower engagement

PRINCIPLES

#1 Be Inclusive

#2 Emphasis on Bottom-Up Organization

#3 Let People Speak for Themselves

#4 Work Together in Solidarity and Mutuality

#5 Build Just Relationships Among Ourselves

<https://www.ejnet.org/ej/jemez.pdf>



III. A ~~Brief~~ Medium-Length History Lesson



Environmental Justice in 2023 – How did we get here?

Late
1960s

CIVIL RIGHTS MOVEMENT, socialized the public health dangers for communities and individuals of color.

Professor Robert Bullard (“Father of Environmental Justice”) wrote: *“whether by conscious design or institutional neglect, communities of color in urban ghettos, in rural ‘poverty pockets’, or on economically impoverished Native-American reservations face some of the worst environmental devastation in the nation.”*

Late
1960s

ENVIRONMENTAL JUSTICE MOVEMENT FORMS AS COMMUNITIES SEEK TO ADDRESS INEQUITIES IN ENVIRONMENTAL PROTECTIONS.

1970s
–
1980s

EJ EFFORTS ARE TARGETED AT SOLID WASTE AND LANDFILL DISPOSAL RESULTING IN GROUNDWATER AND AIR POLLUTION FROM INCINERATION AND LEAKAGE



Environmental Justice in 2023 – How did we get here?

1980s
–
1990s

COALITION BUILDING AND ACCELERATION OF MOVEMENT, through formation of community groups, advisory councils, and non-profit organizations like West Harlem Environmental Action (WE ACT), the Indigenous Environmental Network, and Southwest Network for Environmental and Economic Justice (SNEEJ).

1991

FIRST NATIONAL PEOPLE OF COLOR ENVIRONMENTAL LEADERSHIP SUMMIT

1992

DEEP SOUTH CENTER FOR ENVIRONMENTAL JUSTICE, NATION'S FIRST EJ CENTER, FOUNDED

1992

FEDERAL OFFICE OF ENVIRONMENTAL EQUITY ESTABLISHED

1993

EPA CONVENES NATIONAL ENVIRONMENTAL JUSTICE ADVISORY COUNCIL



Environmental Justice in 2023 – How did we get here?

1994

PRESIDENT CLINTON’S EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS | FEBRUARY 11

“...each federal agency shall develop an agency-wide environmental justice strategy that identifies and addresses disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.”

1994

OFFICE OF ENVIRONMENTAL EQUITY RENAMED OFFICE OF ENVIRONMENTAL JUSTICE

1995

DOE’S FIRST EJ STRATEGY, OVERSEEN BY THE DOE OFFICE OF LEGACY MANAGEMENT

1996

JEMEZ PRINCIPLES FOR DEMOCRATIC ORGANIZING DRAFTED IN JEMEZ, NM, FACILITATED BY SNEEJ

1999

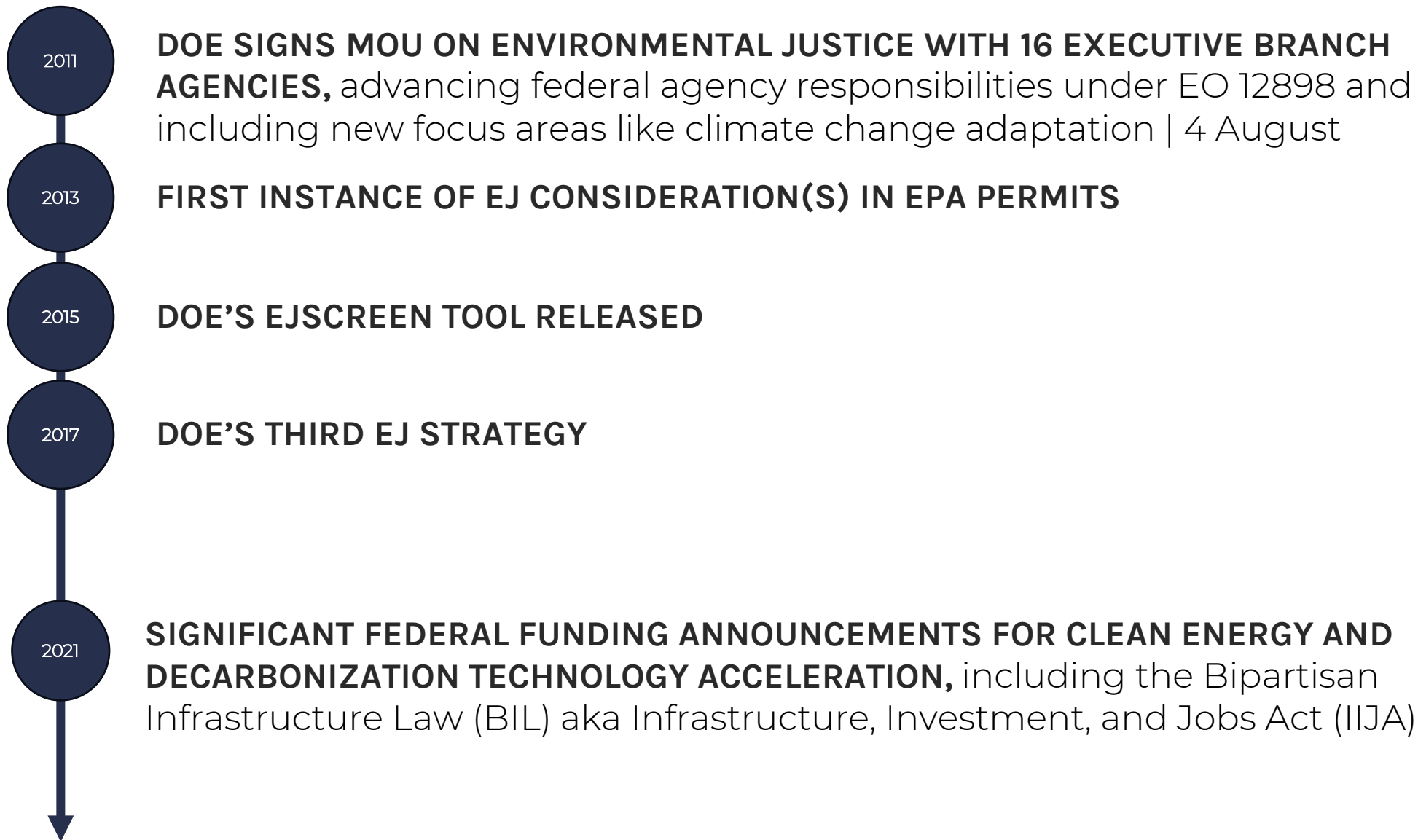
NATIONAL BLACK ENVIRONMENTAL JUSTICE NETWORK (NBEJN) LAUNCHES

2008

DOE’S SECOND EJ STRATEGY, AND ENVIRONMENTAL JUSTICE FIVE-YEAR IMPLEMENTATION PLAN



Environmental Justice in 2023 – How did we get here?





Environmental Justice in 2023 – How did we get here?

2022

PRESIDENT BIDEN’S EXECUTIVE ORDER 14008, “TACKLING THE CLIMATE CRISIS AT HOME AND ABROAD.”

“Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related, and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts.”

- **INTRODUCED THE JUSTICE40 INITIATIVE**, directs 40% of the overall benefits of certain Federal investments to flow to disadvantaged communities (DACs).
- **CREATED THE WHITE HOUSE ENVIRONMENTAL JUSTICE ADVISORY COUNCIL**

2022

INFLATION REDUCTION ACT (IRA)

2023

COMMUNITY BENEFITS PLANNING REQUIRED AS PART OF RESPONSE TO FEDERAL FUNDING ANNOUNCEMENTS, prompting consideration of equity and environmental justice, most commonly in four ways: community and stakeholder engagement, quality jobs and economic development, Justice40, and Diversity, Equity, Inclusion, and Accessibility (DEIA).



Now you're up to speed!



APPLICATION AND RELEVANCE



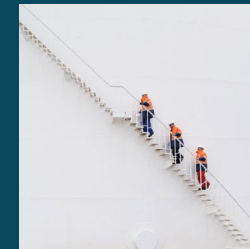
Federal Funding Requirements

Current federal funding includes requirements to consider Community Benefits (and Burdens), as well as comply with Justice40



Moral Imperative

How can we center communities in conversations about development? What do communities deserve and how can we complement development needs with community values?



Achieving Win-Wins

Industry wants tenure in a community, and market expansion, both of which are achieved – or amplified - by social license to operate



Federal Funding Requirements

Justice40

40% of benefits to DACs.

Interim guidance from 2021 provided by OMB.

Active efforts to quality metrics for quantifying DAC and EJ.

Community Benefits Planning

Often three components, required to satisfy evaluation criteria for competitive federal funding:

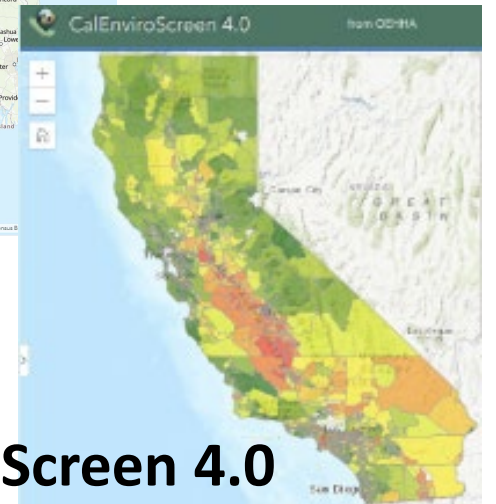
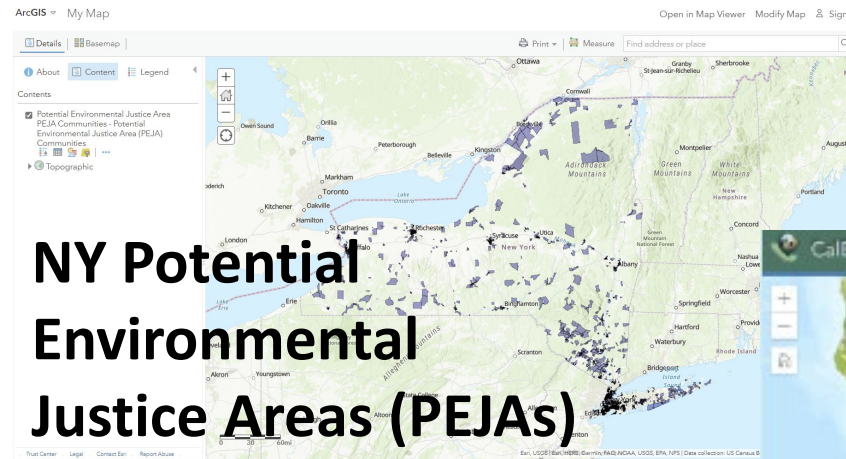
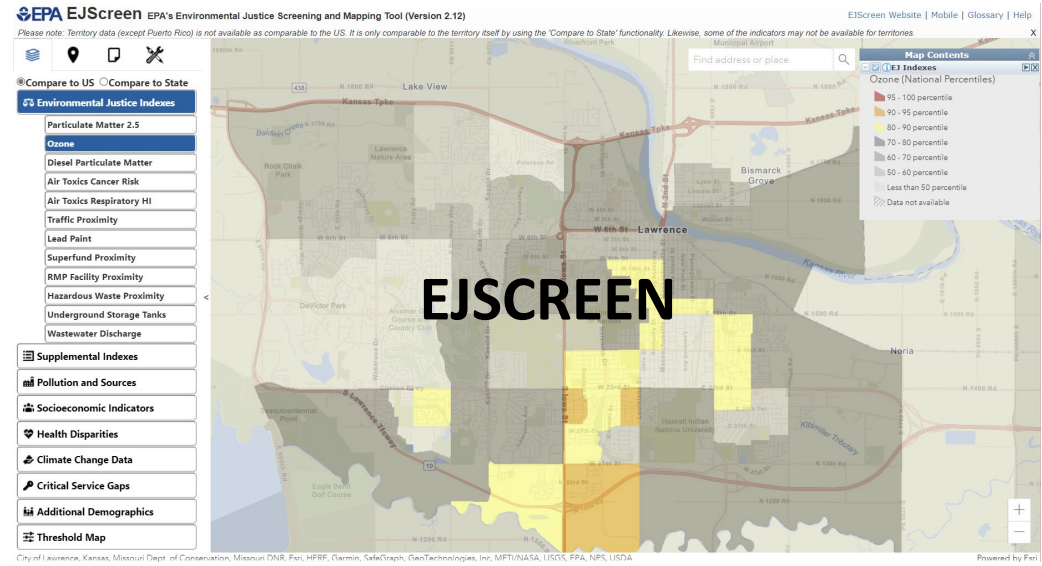
- Community and Stakeholder Engagement
- Jobs and Workforce Development (e.g., Quality Jobs)
- Diversity, Equity, Inclusion, and Accessibility (DEIA)



Establishing Metrics to Quantify DAC and J40

Evolution of Tools is Ongoing

- EPA's EJ Screen
- Supplemental State-level Analysis, including NY State's Potential Environmental Justice Areas (PEJAs) and California's CalEnviroScreen 4.0



CalEnviroScreen 4.0

Establishing Metrics to Quantify DAC and J40



Community and Economic Justice Screening Tool (CJST)

Carbon Solutions

Explore the map

Share data sources with CEQ

Census tracts that are overburdened and underserved are highlighted as being disadvantaged on the map. Federally Recognized Tribes, including Alaska Native Villages, are also considered disadvantaged communities.

Zooming in and selecting shows information about each census tract.

Get the data

Download the data with documentation and shapefile from the [downloads](#) page.

How to use the map:

Zoom in +, search, or locate yourself and select to see information about any census tract.

Things to know:

The tool uses census tracts. Census tracts are a small unit of geography. They generally have populations of between 1,200 - 8,000 people.

Communities that are disadvantaged live in tracts that experience burdens. These tracts are highlighted on the map.

The tool ranks most of the burdens using percentiles. Percentiles show how much burden each tract experiences when compared to other tracts.

Thresholds, or cutoffs, are used to determine if communities in a tract are disadvantaged. Certain burdens use percentages or a simple yes/no.

Land within the boundaries of Federally Recognized Tribes and point locations for Alaska Native Villages are highlighted on the map. These communities are also considered disadvantaged.

Search for an address, city, state or ZIP

31st St
13th St
Midland
LWC
Lawrence
Bismark Grove
University of Kansas
Noria
S Lawrence Trailway
Sibleyville
Havans

48
AK
HI
PR
GU
AS
MP
VI

Tract information
Number: 20045000100
County: Douglas County
State: Kansas
Population: 2,728

Tract demographics
Race / Ethnicity (show)
Age (show)

Identified as disadvantaged?
NO

This tract is not considered disadvantaged. It does not meet any burden thresholds OR at least one associated socioeconomic threshold.

Send feedback

Climate change	+
Energy	+
Health	+
Housing	+
Legacy pollution	+
Transportation	+
Water and wastewater	+
Workforce development	+

Methodology version 1.0

© Mapbox © OpenStreetMap improve this map

8 Dimensions:

1. Climate Change
2. Energy
3. Health
4. Housing
5. Legacy Pollution
6. Transportation
7. Water and wastewater
8. Workforce Development



Example Efforts Integrating EJ Principles



EXAMPLE APPLICATION:

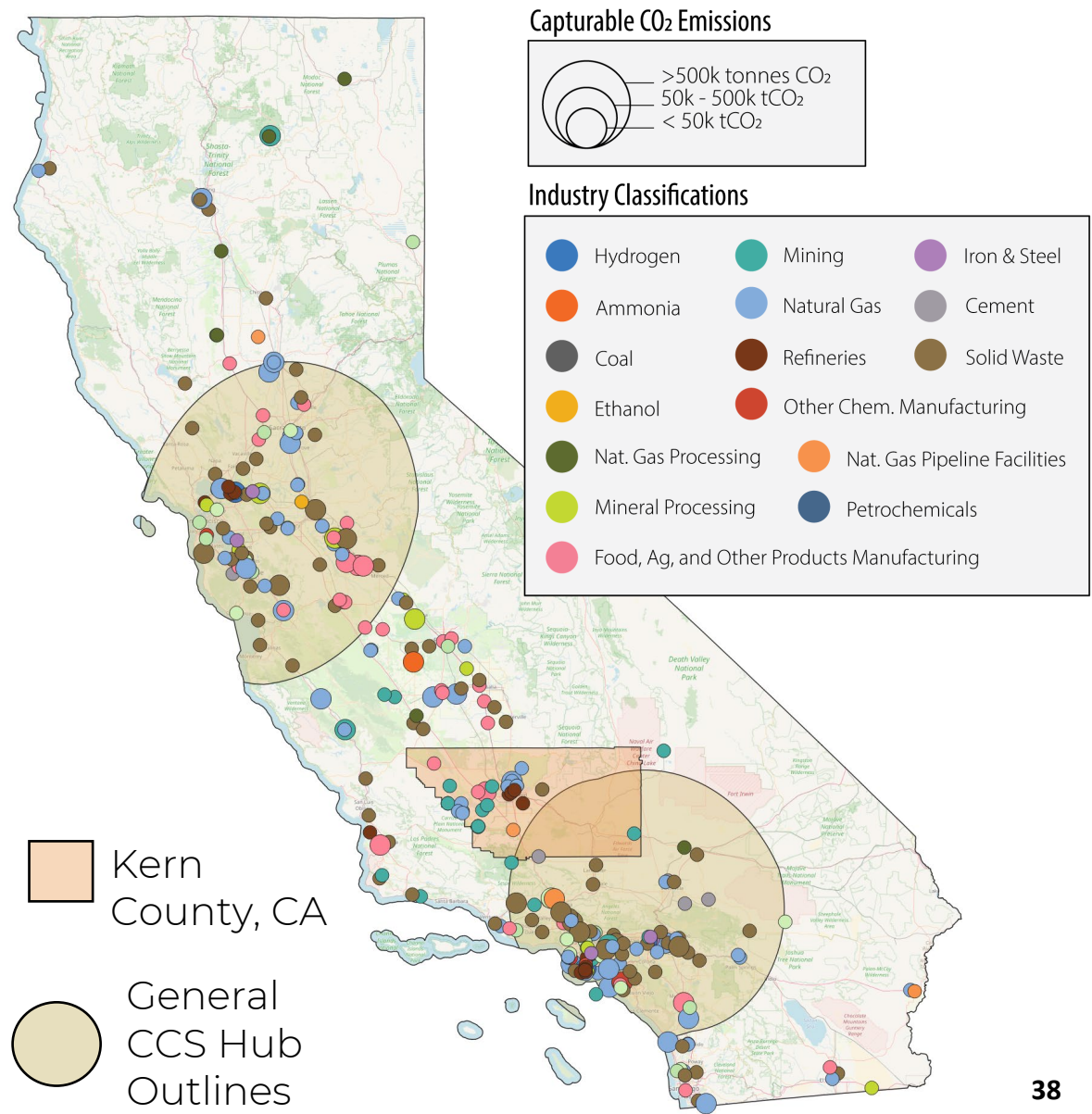
CUSP Focused Project: Laying the Cornerstones of a Regional Storage Hub in California

Objectives:

- Investigate storage volumes and dynamic storage capacity in targeted saline formation
- Evaluate potential pathways to deploy a regional storage hub in the Southern San Joaquin Basin

Project Lead: Stanford University
 Partners: Sentinel Peak Resources (SPR), Carbon Solutions, Montana State University

Carbon Solutions



EXAMPLE APPLICATION:

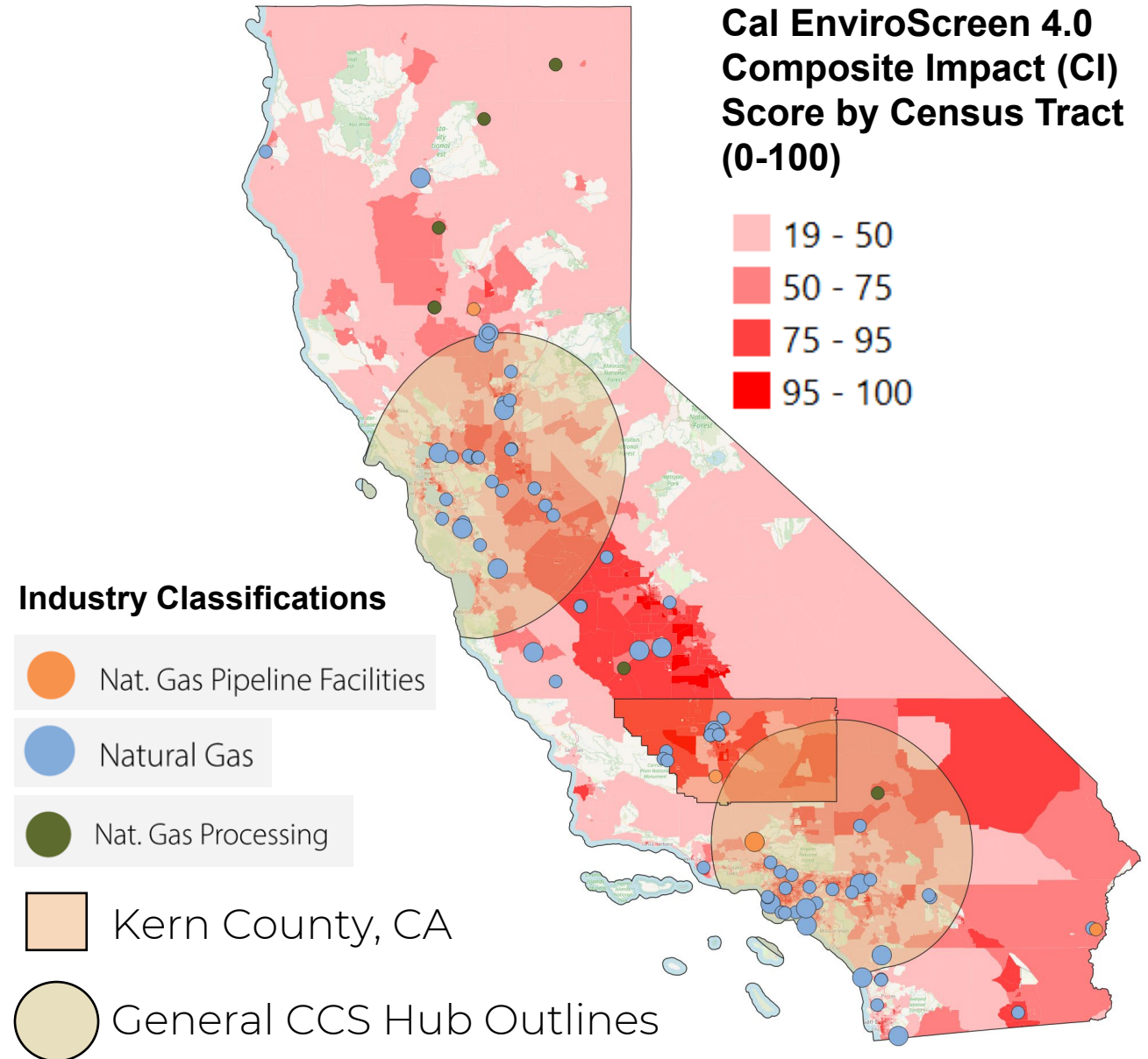


CUSP Focused Project: Laying the Cornerstones of a Regional Storage Hub in California

Current Research Priorities

- Understand the extent of capturable potential across state industries, with focus on natural gas
- Contextualize potential for centralized storage hub across all parts of CCUS value chain
- Consider impact of environmental justice on siting infrastructure

Carbon Solutions





Scenario Development

Consider three variables of influence within the CCS system:

- (1) Capture.** Capture costs were estimated from CO2NCORD, or for steam thermal facilities for inflation updates from Kim et al, (2022) to USD\$2023
- (2) Storage.** Considers storage at a coordinated (illustrative) hub site, versus independent given available geology.
- (3) Environmental Justice census tracts as weight input for routing surface.** Census tracts across California identified as environmental justice census tracts were either given a preferential weight (prioritize) or a deferential weight (exclude) in the weighting cost surface calculations.



Nine scenarios isolated three parameters of interest

Carbon Solutions

Scenarios	Facilities	Storage	Routing Surface
S1: All facilities, reference	All facilities in California, including identified steam-thermal	Extent of CA geology available in SCO2 ^{PRO}	Default routing surface assumptions
S2: All facilities, prioritize EJ in routing			Routing weights preference EJ census tracts (with a lower relative weight)
S3: All facilities, exclude EJ in routing			Routing weights preference non-EJ census tracts (giving a relatively higher weight to EJ census tracts)
S4: Only steam thermal, reference	Only steam-thermal* facilities (reference Kim et al, 2022)	Storage available as illustrative hubs (Tehama, Central, and Kern)	Default routing surface assumptions
S5: Only steam thermal, prioritize EJ in routing			Routing weights preference EJ census tracts (with a lower relative weight)
S6: Only steam thermal, exclude EJ in routing			Routing weights preference non-EJ census tracts (giving a relatively higher weight to EJ census tracts)
S7: All facilities, hub storage, reference routing	All facilities in California, including identified steam-thermal	Illustrative hub storage sites (Tehama, Central, and Kern)	Default routing surface assumptions
S8: All facilities, hub storage and prioritize EJ in routing			Routing weights preference EJ census tracts (with a lower relative weight)
S9: All facilities, hub storage, and exclude EJ in routing			Routing weights preference non-EJ census tracts (giving a relatively higher weight to EJ census tracts)

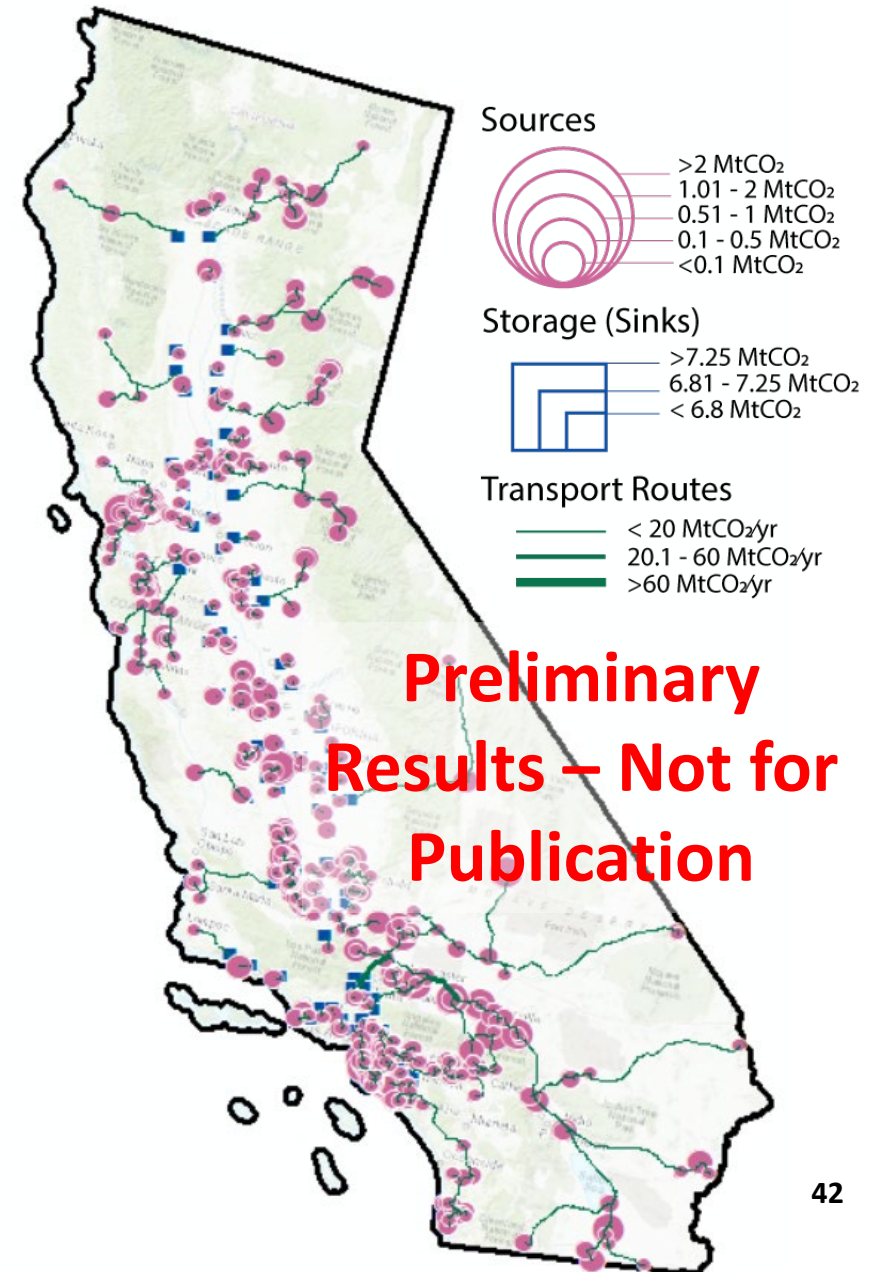
S1: All facilities, reference routing



Total Captured CO₂ emissions: 181.51 MtCO₂

Total Pipeline Network Length: 6,212.33 km

Scenarios	Capture (\$/tCO ₂)	Transport (\$/tCO ₂)	Storage (\$/tCO ₂)	Total (\$/tCO ₂)
S1	\$102.55	\$6.75	\$6.66	\$115.96



Assumptions:

- All facilities with modeled capturable emissions, including steam thermal
- Extent of modeled CA geology made available
- Standard routing surface
- Limitation: Capturable volumes of CO₂

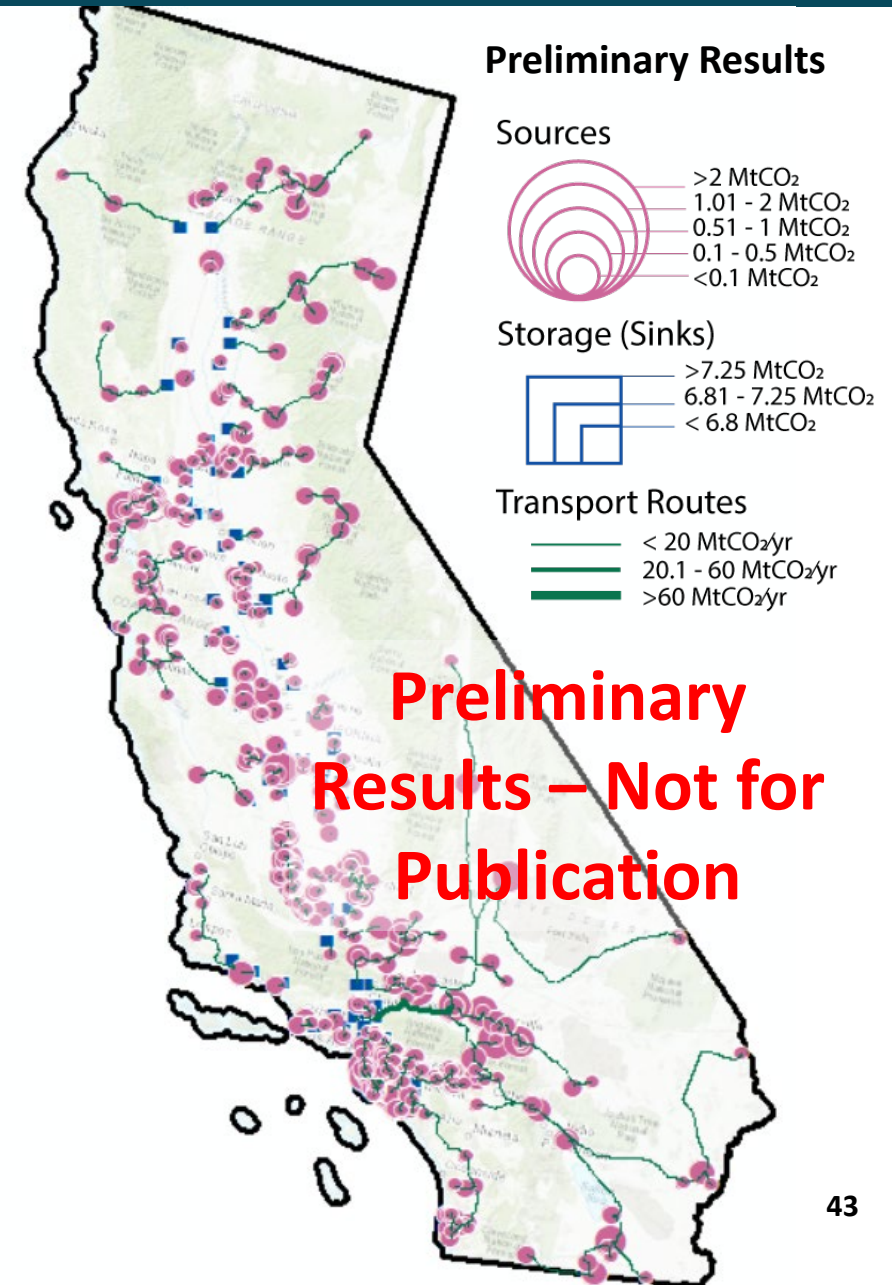
S2: All facilities, prioritize EJ in routing



Total Captured CO₂ emissions: 181.51 MtCO₂

Total Pipeline Network Length: 5,860.02 km

Scenarios	Capture (\$/tCO ₂)	Transport (\$/tCO ₂)	Storage (\$/tCO ₂)	Total (\$/tCO ₂)
S2	\$102.55	\$10.81	\$6.62	\$119.99



Assumptions:

- All facilities with modeled capturable emissions, including steam thermal
- Extent of modeled CA geology made available
- Routing surface prioritizes (gives “cheaper” cost weight) to EJ-designated census tracts
- Limitation: Capturable volumes of CO₂

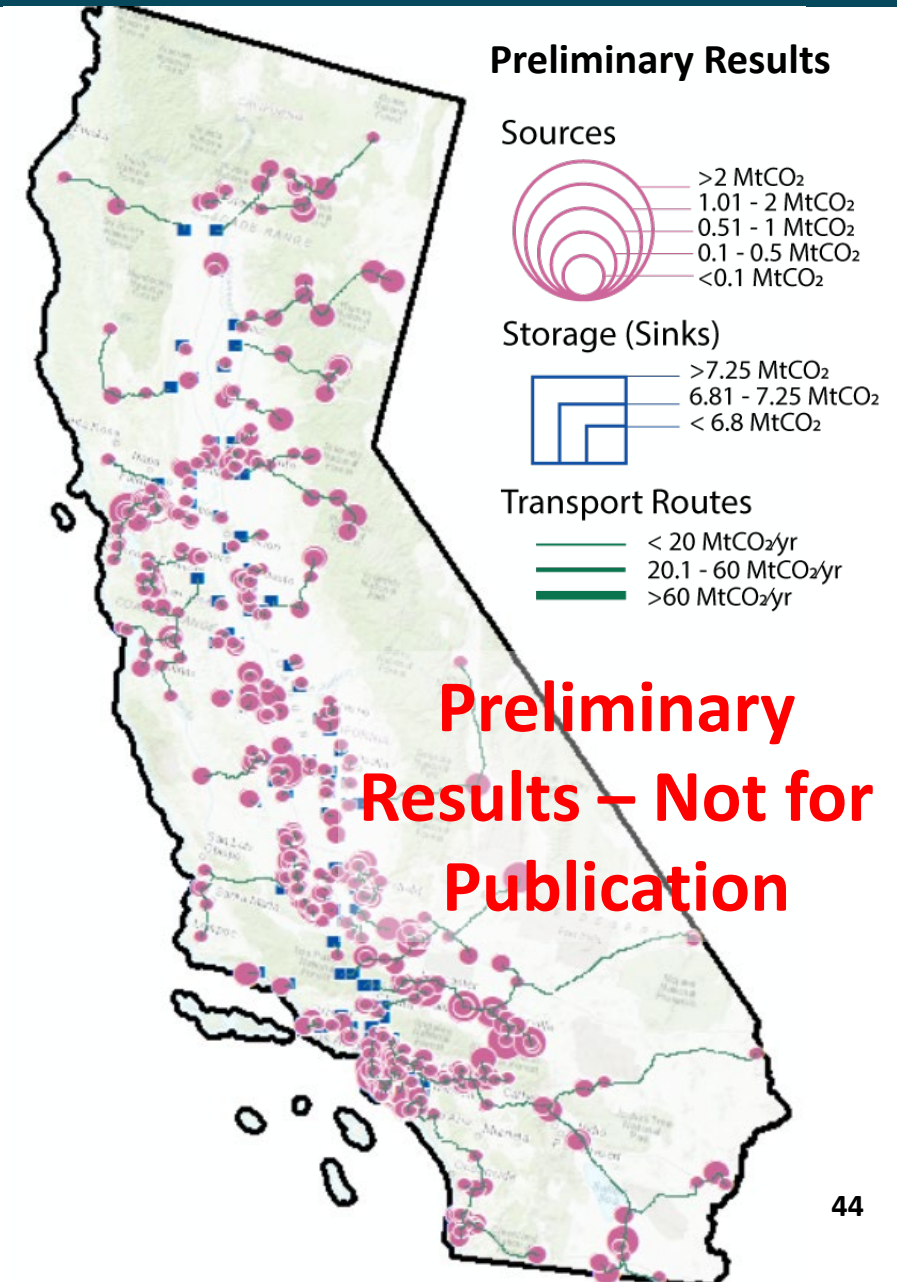
S3: All facilities, exclude EJ in routing



Total Captured CO₂ emissions: 181.51 MtCO₂

Total Pipeline Network Length: 5,727.48 km

Scenarios	Capture (\$/tCO ₂)	Transport (\$/tCO ₂)	Storage (\$/tCO ₂)	Total (\$/tCO ₂)
S3	\$102.55	\$13.47	\$6.89	\$122.91

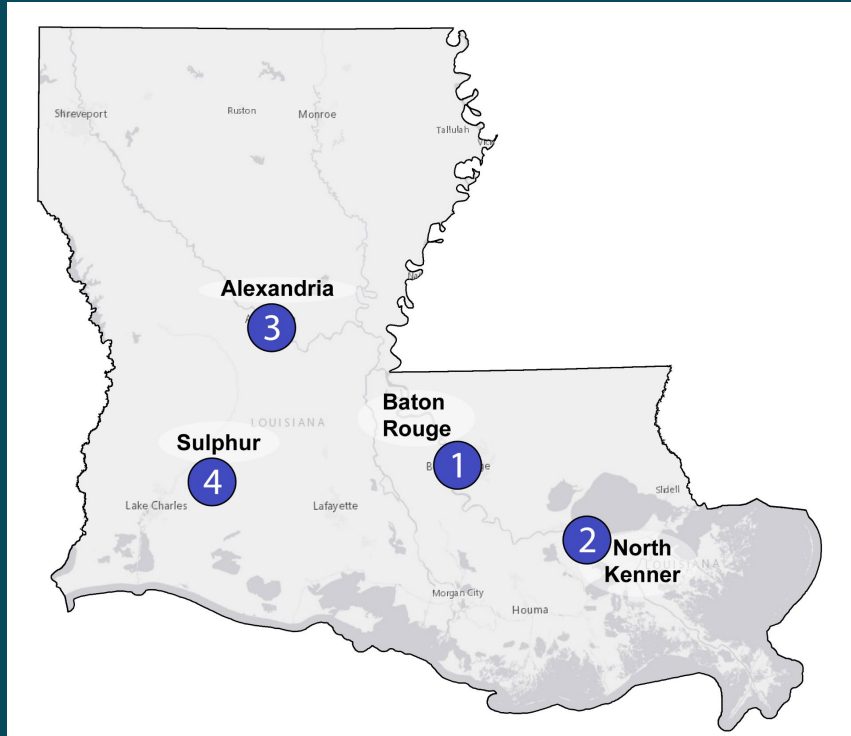


Assumptions:

- All facilities with modeled capturable emissions, including steam thermal
- Extent of modeled CA geology made available
- Routing surface excludes (gives “higher” cost weight) to EJ-designated census tracts
- Limitation: Capturable volumes of CO₂



Evaluation of Community Roundtables in Louisiana



Four Community Roundtables were held in May and June 2023 across the state of Louisiana. Stakeholders were convened in the communities of North Kenner, Baton Rouge, Alexandria, and Sulphur.

Purpose of the Roundtables:

- (1) Evaluate a beta decision-support tool that integrated social/demographic and environmental siting considerations to think about CCUS deployment
- (2) Facilitate initial conversations with local communities about CCUS

Evaluation of Community Roundtables in Louisiana



Preliminary Insights:

1. Communities require **local context** to inform conversations around siting and deployment of CCUS technologies
2. Community **readiness for conversations** about CCUS **vary tremendously**, even within a state or region
3. **History and experience** with industry actors will have significant **impact on expectations for CCUS technology** and the CCS industry

Report of full summary findings forthcoming!





What comes next?

01. Accommodate fluid dimensions of equity and environmental justice as an increasing number of communities weigh in on what it means for them.
02. Continue to integrate environmental justice and equity considerations into CUSP research and pilots through evaluation, monitoring, & more.
03. Mitigate against potential risk from “bad faith actors” who could tarnish industry’s the social license to operate.



THANK YOU!

CONTACT.



Website

Carbonsolutionsllc.com



Email

Jessi.eidbo@carbonsolutionsllc.com

