CARBON SOLUTIONS

Advancing Community-Driven Deployment of Carbon Management Technologies:

Evaluation of Carbon Management Roundtables in Louisiana and Lessons for Future Engagement

Prepared by: Carbon Solutions

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Authors and acknowledgments

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Community hosts
Franklin Associates Event Center
Jefferson Parish, North Kenner Community Library
Westside Regional Library
West Cal Arena and Events Center

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Terms and acronyms

Terms

Carbon capture	Refers to a group of technologies that prevent industrial and electric power facility carbon emissions from reaching the atmosphere or removing carbon dioxide from the atmosphere.[1]
Carbon management	Mechanical and biological solutions to removing carbon dioxide from Earth's atmosphere. Common types of carbon management technologies include carbon capture at a point source of emissions, and direct air capture.
Carbon reuse	The reuse of CO_2 or carbon monoxide (CO) to produce valuable products, such as low- and zero-emissions fuels, building materials, and other products that reduce greenhouse gas emissions as compared to products or processes typically derived from fossil fuels.[2]
Census tract	An administrative district used in collating census data.[3]
Class VI well	A well that injects carbon dioxide for the purposes of long-term storage, also known as CO_2 geologic storage.[4]
Decarbonization	The process of reducing or eliminating CO_2 emissions from industrial processes and power production.
Geologic storage	The storage of captured CO_2 through injection into deep geological reservoirs, principally saline formations.[1]
Hydrogen	A nonmetallic gaseous chemical element with atomic number 1 that is the simplest and lightest of the elements and is used especially in the processing of fossil fuels and the synthesis of ammonia.[5]
Renewable energy	Generally, electricity generated from renewable energy sources, such as wind and solar power, geothermal, hydropower, and various forms of biomass. Energy sources are considered renewable because they are continuously replenished on the Earth.[4]
CO_2 storage/ sequestration	Process by which trees and plants absorb carbon dioxide, and release the oxygen and store the carbon. Geologic CO_2 storage involves injecting CO_2 deep underground for permanent storage.[4]
Storage reservoir	Subsurface geologic formation for storing CO_2.
State primacy	A state's ability to be responsible for Class VI well permitting and the authority to enforce a law and related regulations.[4] Once granted, state primacy replaces federal oversight, which is only conferred through a federal ruling when a state meets or exceeds federal regulations.

Acronyms

BIL	Bipartisan Infrastructure Law
CAB	Community Advisory Board
CBA	Community benefits agreement
CCS / CCRS	Carbon capture and storage / Carbon capture, reuse, and storage
CM	Carbon management
CO_2	Carbon dioxide
CarbonSAFE	Carbon storage assurance facility enterprise
DBE	Disadvantaged business enterprise
DOE	Department of Energy
DAC	Disadvantaged communities
DAC	Direct air capture
DAC+S	Direct air capture and storage
EOR	Enhanced oil recovery
HI	Hazard index
IRA	Inflation Reduction Act
MW	Megawatt
MBE	Minority-owned business enterprise
NIMBY	Not in my back yard

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Executive Summary

Introduction and motivation

Recent substantial federal investment in carbon management projects, along with the increasing urgency to deploy technology solutions to mitigate the impacts of climate change, has created a great need for strategic community engagement around carbon management technologies. At the same time, the U.S. government recognizes that future development needs to consider the impact new energy projects will have on underserved, overburdened, and disadvantaged communities. To help communities, tribal members, stakeholders, and the federal government begin to measure who is impacted by projects now, how benefits and risks might be distributed in the future, and how disadvantaged communities may be impacted relative to non-disadvantaged communities, several tools have emerged to help define who disadvantaged communities are and where they are located.

While current environmental justice tools help identify which communities are disadvantaged, there are two ways they could be improved; they do not integrate physical, environmental, social, and demographic characteristics of a place in a way that is necessary for understanding initial siting decisions, and communities are not often able to comment on the usefulness of this tool in siting projects before they break ground. To bridge this information, decision support, and carbon management gap, the Great Plains Institute (GPI) partnered with SWCA to develop a decision support tool for Louisiana.

The tool aims to provide a platform for stakeholders, broadly, to explore community, social, and environmental landscape data that might be important or of relevance as carbon management projects are being evaluated or proposed in Louisiana. It allows users to interface with data through an interactive story map, where layers of information can be turned on and off. The team spent considerable time distilling large volumes of information about siting and social factors into composite scores, including a score for social factors, a score for environmental factors, and a composite score of the two. While the tool itself makes no judgment about whether it is good or bad to site something in one location over another, it allows users to investigate various dimensions of siting or locating a project within the state that they may be interested in better understanding. More information about the tool is available in the Appendix of this report.

Roundtable overview

In the spring of 2023, GPI and SWCA presented their siting tool to communities in Louisiana through a series of community roundtable discussions. Facilitated by Franklin Associates, the pilot roundtable format was used as a way to engage communities about carbon management in four locations across Louisiana. These roundtables welcomed community members to participate in conversations about carbon management technologies and provide feedback on the draft tool. As one of the first instances of intentional, community-driven engagement specific to carbon management technologies, the roundtables provided an ideal opportunity to evaluate community engagement.

During this evaluation, Carbon Solutions sought to identify 1) elements of the roundtables that could serve as replicable and 2) scalable demonstrations of current best practices for

community engagement. Carbon Solutions evaluated how the community engaged with and understood the tool, and how the tool could aid in facilitating community engagement about carbon management. The roundtables also presented the opportunity for Carbon Solutions to identify model methods used during the roundtables that, in practice, may not be as effective as intended.

Recommendations

Carbon Solutions developed a series of recommendations from our roundtable meetings. First, we suggest that engagement efforts should **employ skilled, local facilitators** to engender trust with the impacted community. Facilitators should have experience in, and some level of social ties with the area, and also be trained in facilitation methods. Secondly, it is important to **compensate attendees**—their time and local expertise have value. Depending on the length of the engagement activities, providing food or other refreshments can make attendees more comfortable. Thirdly, engagement efforts should **clearly articulate engagement objectives**. The motivations of the conveners should be made explicit, and the meeting should have a precise goal.

Our fourth recommendation is to **provide background knowledge to attendees, including an overview of carbon management.** Carbon management technologies are not broadly understood, and some communities have no experience with these technologies. Background knowledge should be tailored to the audience and provided in plain language. Fifth, there should be **multiple pathways for feedback**—a single roundtable or meeting is not sufficient, and dialogue should occur across multiple platforms. Our sixth recommendation is that **communication channels stay active,** conveners and facilitators should continue to seek feedback and input after meetings and continue to provide information about the project. We also identified key pitfalls based on our experience with the roundtables. Among these is a **lack of representation**—those who attend meetings may not necessarily represent the views of the community. We also observed that **inconsistent facilitation** can be problematic, we suggest that facilitators should approach the meetings in the same manner, with the same goal and approach.

The engagement efforts pointed to broader considerations. First, we suggest that developers must **evaluate community readiness to prepare for strategic engagement.** These include considerations such as a community's experience with carbon management, willingness to embrace economic development opportunities, and implementation of a climate action plan, among many others. Secondly, **engagement materials should be right-sized to community readiness**—that is, engagement materials should be carefully adjusted to the needs of a community and its unique history. Lastly, **engagement should be strategically and sufficiently timed based on community readiness**. Providing information too early may lead to fatigue around requests for public input, an incorrect belief that a project is farther along than it is, or the false belief that tax or job benefits are larger than the eventual project size.

Background and Context

Motivation

Curtailing carbon dioxide (CO_2) emissions, generated through the combustion of fossil fuels in industrial, manufacturing, and transportation sectors, along with electricity production from natural gas or coal-fired power plants, is a goal of many international, federal, and state policies. The U.S. has an objective of net-zero by 2050, which requires that for every greenhouse gas molecule that is emitted, there must be a way to reduce greenhouse gas emissions by the same amount. Some emissions will be reduced by changing technologies, such as utility-scale solar or wind farms. However, some industrial processes are more difficult to change. The comprehensive array of secure, efficient, and increasingly cost-effective technologies employed to manage, reduce, and eliminate CO_2 emissions from industrial facilities, power plants, and even directly from the air is collectively known as carbon management. These techniques encompass carbon capture, removal, transport, reuse, and storage, offering the capacity to repurpose the captured CO_2 for valuable products or transport it to suitable locations for geological storage.

While many aspects of carbon management are not new, the speed at which projects are being funded is unprecedented. In addition, there is federal recognition that how and where projects happen is important, especially for carbon management. Commitment to an equitable and just energy transition is reflected in the Justice40 Initiative, which seeks to increase who has input on how projects develop, measure where projects are sited relative to disadvantaged and tribal communities, and evaluate how project risks and benefits impact disadvantaged and tribal communities now and in the future.

Using tools to enhance community conversations

To evaluate how a project may impact disadvantaged communities, it is imperative to define a disadvantaged community. A range of state and federal tools have been created, most of which take environmental exposure data—such as levels of ozone, presence of hazardous waste, or air quality information; socio-economic data, such as highest reported levels of education, race or ethnicity, and unemployment levels; and/or health outcome data, such as percentage of low birthweight infants or life expectancy—to create a database of factors typically associated with communities that are marginalized, underserved, or overburdened by past pollution. While each tool differs in the weights it gives each factor, most combine variables at the Census-tract level, the smallest geographic boundary available for most communities, and calculate how one tract ranks compared to all others in either the state or nation.

The purpose of identifying disadvantaged communities in readily available, publicly accessible, easy-to-use online maps is three-fold; it allows a community to understand the burdens it faces relative to others, it lets project planners understand more about the community where their project will be sited, and it allows a mechanism to track how a project may positively or negatively impact communities over time by establishing a baseline of socio-economic, health, and environmental exposure data.

While tracking this information has great value, there are often also physical characteristics related to siting that need to be considered, both by project planners and by community members. Understanding where there are protected lands or habitats, migratory paths, open spaces, or existing areas of cultural importance is critical in the early stages of planning.

Moreover, by presenting this tool to communities, they are better able to define which information may be missing and explore which categories are most important to them.

To integrate these siting considerations into one tool, GPI and SWCA developed the Louisiana Decision Support Tool, bringing together health, environmental exposure, demographic, and physical environment characteristics into one tool. Recognizing that a tool is only as useful as how often it gets used, it was presented to community groups using a roundtable format. This allowed community members to learn about carbon management using a hands-on, interactive tool with data tailored to their state. The roundtable format created an opportunity to discuss carbon management and its potential impacts on communities and presented this information while community members could access real data about their communities, in real-time. **This report discusses the use of roundtables in the early stages of carbon capture, reuse, and storage projects, and describes what happened at these events, what might work in other locations, and what key take-aways may make future roundtable events even more successful.**

Why Louisiana

Louisiana is a natural location to have intentional conversations about carbon management technologies. In this section, we briefly explain what is unique about Louisiana, while also highlighting other areas of the country experiencing similar carbon management investment. In our evaluation of this tool, we are striving to balance drawing attention to issues that are rooted in the particular experience of Louisiana while being mindful of how information from roundtables can be applicable to other communities. The factors, detailed briefly below, explain why Louisiana was selected as a pilot location for both this tool and the roundtable discussion.

Geologic setting

Carbon management approaches that rely on carbon storage require certain geologic characteristics. While there are a range of formation types that are capable of storing CO_2, the largest increases in funding from the federal government have been to those in saline formations; that is, formations with water too salty to be used for drinking water but with enough brine to demonstrate they can accommodate storing large volumes of CO_2. These formations are not equally distributed across the United States but are particularly concentrated in certain areas of the country. Figure 1 shows extensive areas of similarly good storage, which are California, Wyoming, Indiana, Illinois, and states bordering the Gulf Coast.

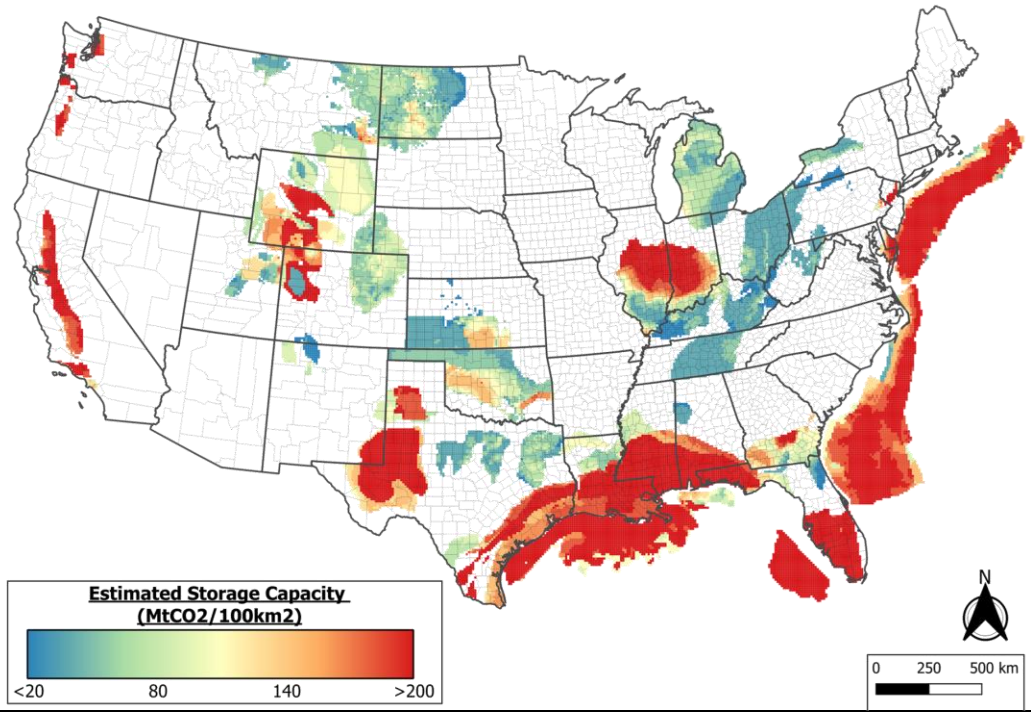

Figure 1. Saline storage capacity in the United States.[6]

Concentration of industrial emission sources

Ideal geology is only one factor needed to accelerate carbon storage projects. Before CO_2 can be stored or reused, it first needs to be captured. Due to its legacy of industrial development, Louisiana has one of the highest total CO_2 emissions in the country.[7] Comparing Figure 1 and Figure 2, California, Texas, Louisiana, Illinois, Indiana, and Florida are a small group of states with both carbon storage opportunities and high CO_2 emissions. It is not required that CO_2 sources and storage locations are near one another; for example, there are approximately 5,000 miles of CO_2 pipelines in the United States,[8] and more CO_2 pipeline projects are planned. However, minimizing the distance CO_2 needs to be routed reduces transportation-related project costs and minimizes the number of landowners required to be consulted to build the pipeline infrastructure.

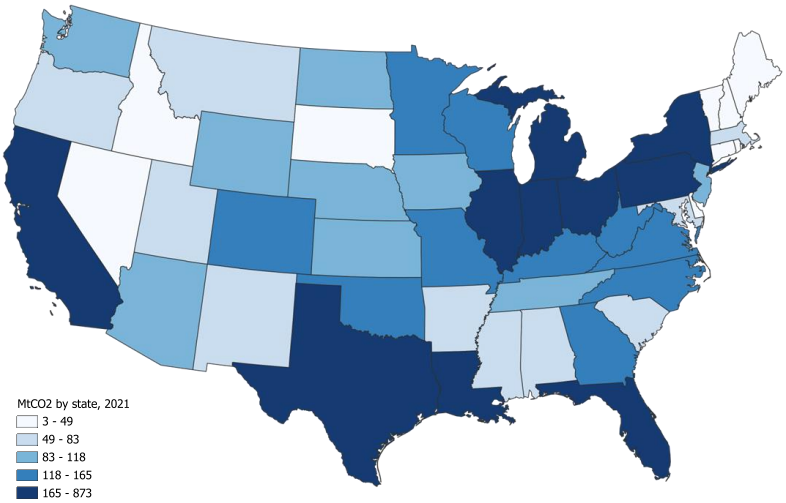

Figure 2. Million Metric tons of CO_2 equivalent in 2021, by state.

Concurrent interest in direct air capture (DAC)

While more "conventional" carbon management technologies like on-site carbon capture and long-term geologic storage are developing in Louisiana, there is concurrent interest in other carbon management technologies like direct air capture (DAC). While carbon capture and storage (CCS), carbon capture, reuse, and storage (CCRS), and DAC are distinct technologies, each relies on similar principles to remove CO_2 (either at the point source or from the atmosphere) and store it underground. Because all CO_2 can be stored in the same geologic formation irrespective of its origin, there are considerable opportunities for both conventional CO_2 emission sources and DAC CO_2 to co-locate storage and transportation infrastructure, which can reduce disruption for communities, reduce the infrastructure footprint, and increase cost-effectiveness for developers.

In Louisiana, favorable geologic storage has proven attractive to DAC developers. In August 2023, the Battelle Memorial Institute ("Battelle") and a team of partners received funding under the U.S. Department of Energy (DOE) through the Bipartisan Infrastructure Law's Regional Direct Air Capture Hub Program. Their project, the Cypress DAC Hub, aims to advance direct air capture with storage (DAC+S) in Calcasieu Parish, Louisiana. Powered by renewable technology, the hub will be net negative and support national leadership on DAC+S technology.[9] This project represents major investments in Louisiana, as it will utilize the plentiful and low-cost geologic storage in the state, helping shape and create dynamic market interest across a suite of carbon management technologies. The other project to receive similar levels of DOE support for DAC is the South Texas DAC Hub, located in Kleberg County, TX. Both projects are located in areas with excellent geology near the Gulf Coast.

State climate action plan

In January 2022, Louisiana became the first state in the Gulf South to adopt a Climate Action Plan.[10] The plan outlines strategies for reducing greenhouse gas emissions and increasing resilience to the impacts of climate change, including extreme weather events and natural disasters through the implementation of eight overarching climate strategies.[10] Key to the state's progress on greenhouse gas emissions reduction is to work with the state's sizable industrial sector, which currently represents the largest sector contribution to the state's total emissions. An entire statewide action is dedicated to industrial decarbonization, which lays out four strategies to tackle the state's largest sector of emissions, as well as benchmarks and metrics for tracking success, highlighting the tremendous opportunity of carbon management technologies to not only significantly reduce industry CO_2 emissions but also emissions from co-pollutants like nitrous oxides (NO_x), sulfur oxides (SO_x), and particulate matter (PM).[11]

The climate action plan also proposes a holistic framework; one which is notably reliant on CCS as one tool to help accelerate industrial fuel-switching to low- or no-carbon fuels and low- or no-carbon feedstocks. The plan is explicit about the desire to support research and development, as well as pilot projects to understand what optimal deployment of CCS should look like for the state. Lastly, opportunities for integration of CCS into the state's industrial systems acknowledge the viability of multiple solution pathways, noting that captured CO_2 can even serve as a feedstock to reduce emissions from chemical production and petroleum manufacturing. This collective effort represents a significant step towards coalition and trust-building with industry actors across the state whom Louisiana is primed to work *with* to

accelerate progress on climate action through carbon management solutions like CCS. It also publicly expresses the state's commitment to leveraging CCS as a climate action strategy, and actively investing in capacity, feasibility research, and dedicated funding to move initiatives forward.

Class VI wells and primacy

All underground injection wells are permitted by the U.S. Environmental Protection Agency (EPA) through the Underground Injection Control (UIC) program. The EPA distinguishes wells into six classes based on the functional characteristics of the well and the type of use, including what will be injected into the well. Two well classes are relevant to conversations about the storage piece of carbon management.

1. **Class II** wells are used to inject fluids associated with oil and natural gas production.
2. **Class VI** wells are specifically for injection of CO_2 into deep, underground geologic reservoirs for the exclusive purpose of permanent storage.[12]

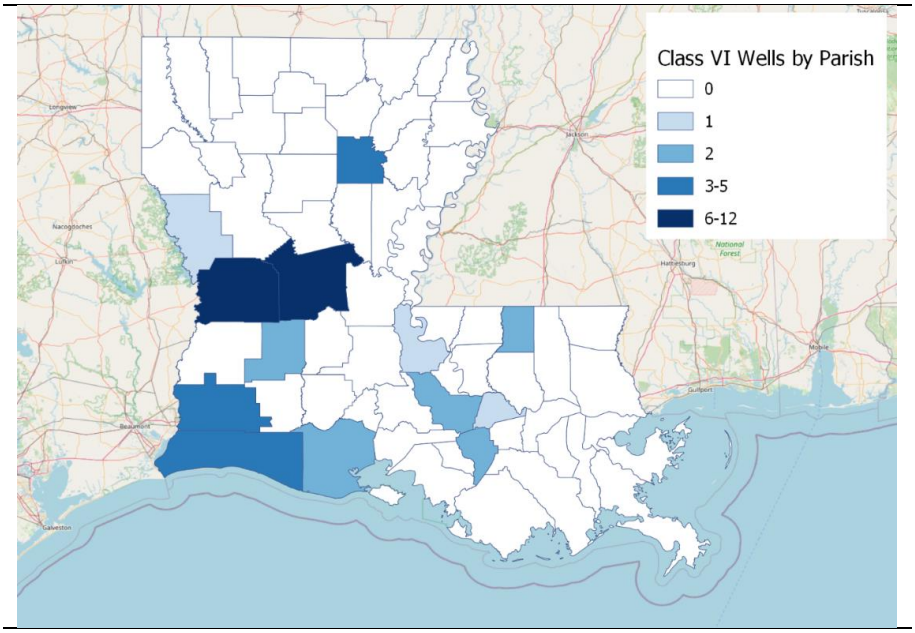

Figure 3. Count of Class VI well applications by parish.[13]

While both Class II and VI wells require permits. the EPA can grant enforcement authority to states, territories, or tribal nations to administer certain well classes in the UIC program while still meeting or exceeding federal standards. When a state, territory, or tribal nation is granted primary enforcement and administrative authority, it then has what is called **primacy.** [4] Primacy can be granted for any of the well classes and can help expedite and localize the permitting process for injection wells.

To date, only two U.S. states have applied for and received Class VI primacy: North Dakota (2019) and Wyoming (2020).[14] Louisiana is actively pursuing Class VI primacy designation. As of April 28th, 2023, the EPA has received and reviewed Louisiana's application for Class VI primacy. Louisiana law was revised to address portions of the Louisiana Department of Natural Resources Class VI primacy application, resulting in an extended public comment period that extended to September 15, 2023.[15]

Primacy designation will have broader near-term implications for carbon management in the state, if granted, due in part to the sheer volume of pending Class VI well applications to EPA. As of early mid-November 2023, there were already 55 wells in the pre-construction phase in

Louisiana pursuing permitting through the EPA (Figure 3). It is likely that if primacy is granted, the volume of Class VI well applications will increase, positioning Louisiana to lead nationally as a storage provider for captured CO_2.[13]

Carbon management policy in Louisiana

Louisiana has been working to better set regulations and guidelines for carbon capture and storage as development pressures ramp up.[16] Historically, the state has adopted supportive legislation to foster a favorable legislative environment for carbon management technology. The Louisiana Geologic Sequestration of Carbon Dioxide Act, House Bill 661, passed in 2009 and is the foundation for carbon capture deployment in the state. Governor John Bel Edwards further prioritized carbon management during his administration. In 2020, Louisiana joined the CO_2 Transport Infrastructure Memorandum of Understanding (MOU) [17] and worked with partner states to create the Regional CO_2 Transport Infrastructure Action Plan, which includes potential policies for states to consider CO_2 transport and storage project deployment.[18]

As of the 2023 legislative session, nine bills were introduced in the House on the topic of carbon management technologies, processes, or regulations. This number is notably higher than ever before. A key focus of these bills, and others, is protecting communities and empowering local voices in decision making. Throughout and after the 2023 legislation session, communities have also expressed hesitation about carbon management project development; communities believe that carbon management projects are coming without sufficient time to research, plan, and respond.

Community engagement and opposition

Increased investment in carbon management can put additional pressure on communities to understand carbon-related projects. In 2021, as an extension of Louisiana's climate action plan, the state's Department of Natural Resources began the process of committing dedicated state lands to carbon storage project development. In October 2021, the state's Mineral and Energy Board approved the first two agreements that lay the groundwork for carbon capture in Louisiana on state lands[19] which generated significant comments from communities.[20] Despite the potential opportunity for revenue generation, some communities have shown opposition to projects moving forward. To date, opposition has included the formation of at least one opposing grassroots group,[21] a defeated moratorium on carbon storage project in Lake Maurepas,[22] substantial public comments related to Class VI well applications,[15] and several bills related to carbon management in the last session.[23]

Summary

Given the fortuitous co-location of carbon storage and CO_2 emissions, a large number of existing class VI well permits, state support for Class VI primacy, the maturation of policies and laws related to carbon management, and the interest in DAC to contribute to carbon management in the state, Louisiana is an exceptional location to understand carbon management opportunities, benefits, and risks from a community perspective.

Roundtable Events

Overview of roundtable structure

To understand how stakeholder roundtable events can support a two-way understanding of carbon management in early project planning stages, four roundtable events were held in various communities across Louisiana in the late spring of 2023. Community locations were selected in coordination with Franklin Associates, and prioritized communities that were likely to see development in the near-term. The roundtable locations and dates were:

1. May 24th in Baton Rouge at the Franklin Associates Event Center.
2. May 25th in Kenner at the Jefferson Parish, North Kenner Community Library.
3. May 31st in Alexandria at Westside Regional Library.
4. June 1st in Sulphur at West Cal Arena and Events Center.

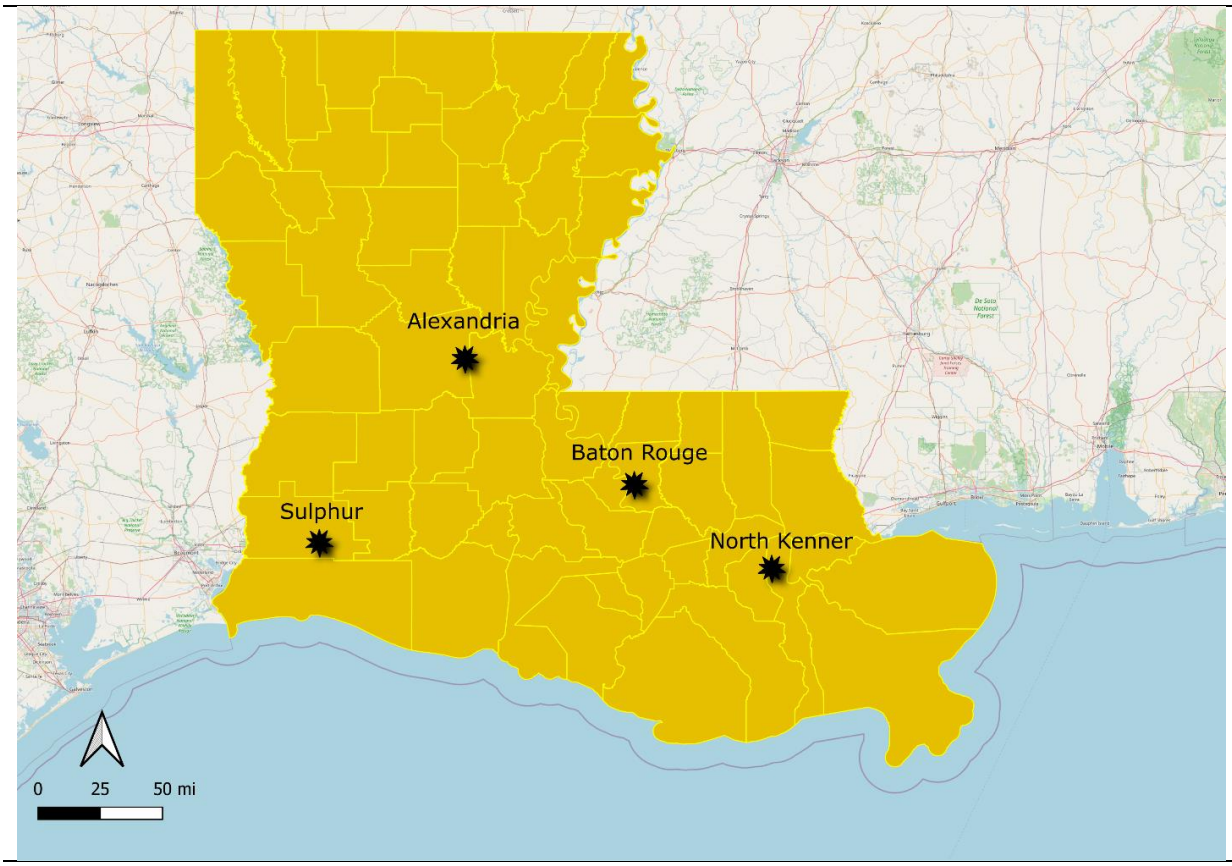

Figure 4. The four roundtable locations around Louisiana are in the communities of Baton Rouge, North Kenner, Alexandria, and Sulphur.

The format of each roundtable was the same. In partnership with a local facilitation and consulting group, Franklin Associates, a group of community members with diverse backgrounds and perspectives were invited to attend. Engagement with potential attendees was organic, and multiple mediums were used to recruit interested community members. Every attendee was compensated for their time and insight in the form of a $150 gift card. A meal was

available at the beginning of the events, and drinks and snacks were available throughout the roundtable.

The primary objective was to capture local perspectives on the considerations most important to local community members around siting carbon management projects. The high-level findings from these conversations would be used to improve the Decision Support Tool for local users. To motivate that conversation, the roundtable was structured to start with a preliminary educational component to prime all attendees. The primer consisted:

- An introduction to the project team.
- An overview of the objectives for the day.
- A presentation on carbon management, including carbon management technologies, a high-level overview of the development process, and topical changes in federal policy increasing interest in carbon management development.
- Dedicated time for attendees to ask questions.

After the primer was presented, the other project partner, SWCA, provided a demonstration and tutorial of the Decision Support Tool. Participants were provided with laptops and an opportunity to explore the beta version of the tool as the tutorial was being given, and there was time given to discuss the data, how the tool worked, and any questions related to carbon management and the tool that participants may have. Finally, the facilitators led the attendees through a discussion, including a set of facilitated questions, to investigate the central question: *What factors are most important to community members when considering siting of carbon management technologies?* The answer to these questions would help the tool weight different factors as important for carbon management.

During the facilitated discussion, attendees were encouraged to continue to ask questions, creating a space both to recognize and potentially alleviate general concerns about carbon management technologies. Because of this, it was extremely important to craft the facilitation in a way that intentionally fostered opportunity for open dialogue, and for community members to ask questions and feel heard. This was partially because these communities were chosen due to the pre-existing development pressure, and as a result, many attendees came to the conversation with some existing information about carbon management, with mixed sentiments towards it. Some attendees arrived with backgrounds in industry and economic development—these individuals were generally supportive, while alternative sentiments included more wariness. To foster that space, the discussions at each roundtable were designed to foster open dialogue, as well as respond to questions not necessarily linked to the Decision Support Tool categories, permitting community members to express their concerns and gain clarification.

Important qualitative insights were generated at each of the four roundtables. Throughout the roundtable discussions, attendees were actively polled for comprehension, opinions, and perspectives. Much of the second half of the roundtable was geared towards generating information that could directly translate to improvements to the Decision Support Tool. These included polling activities, for example, to rank the importance of a set of either social or environmental factor sets.

Baton Rouge

Community snapshot: Baton Rouge

Baton Rouge, the state capital and second-largest city in Louisiana, is home to three universities and colleges including Louisiana State University, Baton Rouge Community College, and Southern University A&M. The city is located along the Mississippi River, which places it within the 100-year floodplain. Highway 10, which also runs along the side of Baton Rouge, is in the 95–100th percentile for flooding risk, a concern if there is an increased risk of flooding.[24] Several environmental concerns are notable in the area: North of Baton Rouge is the Devils Swamp, which holds superfund site status; measurable particulate matter in Baton Rouge is in the 80–90th national percentile; the city is in the 95–100th national percentile for the air toxics measurement of cancer risk; and the city is in the 90–95th national percentile for the air toxics measurement of respiratory hazard index.[24]

The largest industries in Baton Rouge are health care and social assistance, retail and trade, and education services. The median earnings for men and women in Baton Rouge are $36,978 and $25,553, respectively. Employment in Baton Rouge has declined at a rate of 2.92% from 2019 to 2020[25] and currently has an unemployment rate of 3.4%.[25]

Figure 5. Photo of the exterior of the Franklin Associates Event Center building where the first roundtable conversation was held (https://www.franklinassociates.com/about).

Roundtable: Baton Rouge

The first meeting was held in Baton Rouge at the Event Center (Figure 5) owned and operated by the facilitation partner on the team, Franklin Associates. The meeting was well-attended by 17 individuals from the area, who arrived just after noon to find the meeting room holding nine round, circular tables— a format that accurately reflected the event's namesake. As emerged after some opening introductions, many of the attendees knew one another, most often through activities or affiliation with energy, climate, sustainability, or local politics in the area. When

asked, “how many people know the person sitting next to you?” over half of the hands in the room were raised. The age and experience of attendees varied, ranging from students to tenured professionals. Attendees shared experiences working across professional fields, including health care, real estate, renewable energy, local businesses, and non-profit organizations.

After the introduction, the group asked pointed and informed questions about carbon management. They wanted to understand what “fully deployed carbon management technology” would truly look like. Developing carbon capture technology, they explained, seems promising at the moment; however, they had held similar views about the petroleum industry in the past. The group wanted to know how we could ensure that harms related to carbon management would not negatively impact human health or the environment as extensively as the petroleum and industrial sectors.

For other questions, roundtable participants sought to get a more technical understanding of what development entailed. They wanted to understand the efficacy of the technology, considering its potential impact. For instance, they were interested in understanding the extent to which carbon capture could decrease atmospheric CO_2 in Louisiana. Further considerations about CO_2 transport, including safety, as well as waste management were discussed. Attendees wanted to know whether there were potential additional contaminants present in the injected gas present from when the CO_2 went through industrial processes.

Regarding CO_2 safety, attendees wanted to understand:

- The differences between placing CO_2 in a pipeline as opposed to commonly perceived uses like natural gas.
- Fluid pressure mechanics and how dry ice forms when a pipeline ruptures.
- Underground CO_2 injection and the associated risks related to water contamination, along with broader considerations about environmental pollution.

Throughout this portion of the roundtable, people felt comfortable asking questions and showed a sincere desire to learn and better understand the technology. Attendees provided direct feedback for the Decision Support Tool (Figure 6), such as how the tool’s functionality could be explained through video and how the tool could prove useful to a range of stakeholders, providing more information about who and how the tool could be used by different stakeholders. There was active dialogue concerning many aspects of the tool, its data, and its use.

During the final portion of the facilitated discussion, participants considered strategic trade-offs between an “all of the above” approach to decarbonization and climate action technologies, compared to alternative strategies. Participants considered the intentions of various players, especially industry actors in Louisiana. They discussed how industry actors could gain from carbon management technologies by being allowed to carry on with their regular operations, and by making direct profits via tax subsidies. On the other hand, attendees felt a strong urge to implement climate solutions to tackle the state's vulnerability to the impacts of a changing climate, such as intense natural disasters and rising sea levels.

Through this lens, attendees were not shy to ask about complicated dynamics of choice, policy, and behavior around carbon management technology. As the roundtable closed, many people stayed longer than the scheduled time to continue their conversations.

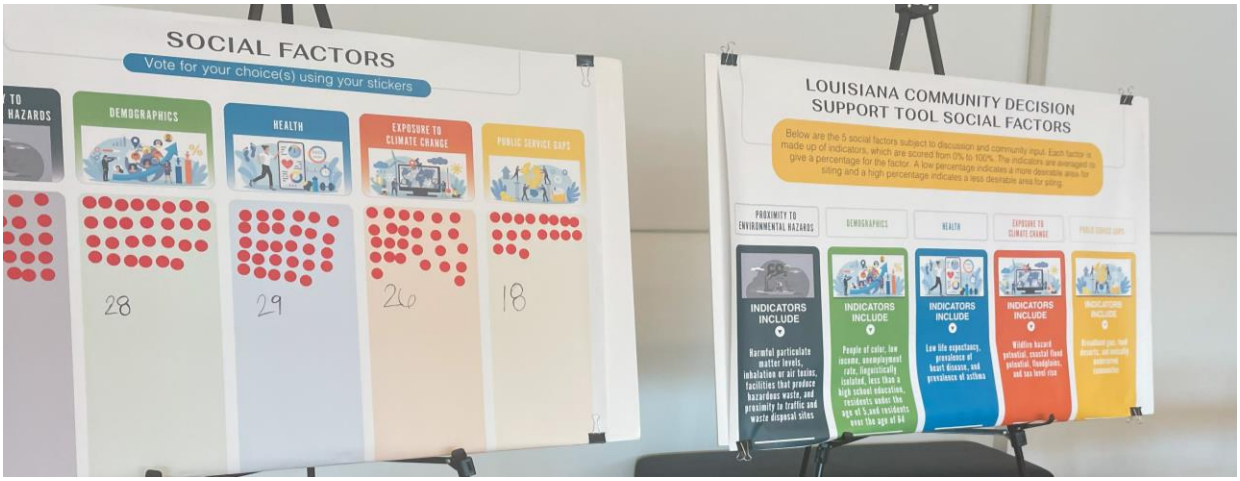

Figure 6. Results from the first roundtable exercise on how social factors in the decision support tool should be weighted.

Key themes: Baton Rouge

1. **From the perspective of building relationships—the true first tenet of successful community engagement—this roundtable was extremely successful, and could serve as a model for other communities.** The facilitated roundtable acted as an opportunity for attendees to actively engage in conversation about carbon management technologies. For this group, that meant learning more about the technology, including important considerations around safety, logistics, operation, efficacy as a climate action strategy, and development impacts. One result of this type of conversation is that it fostered a tremendous sense of community for the attendees in the room. **This conversation would not have been possible without the local facilitators who were critical in establishing rapport and trust with attendees.**

2. **Aligning information with the experience and interest level of each community facilitates better dialogue.** Despite the group having a high-level grasp of carbon management technologies, much of the educational primer was still too technical and in-the-weeds for the audience. For example, when discussing some of the development process pieces, specific engineering and design specifications were reviewed in detail; this information, while important to have available for when attendees have questions, is too granular for an educational primer in this setting. The primer, in its depth, also generated many questions that, while important to cultivate space for, had little to do with the objectives of the conversation for that day.

3. **Having a trusted, expert knowledge broker in the room was essential.** Many of the questions were quite technical, and while the facilitators were key to executing the discussion and dialogue, they were not subject matter experts. Attendees brought many concerns—some real and some myth— to the meeting, and having someone there to broker those concerns, either through acknowledgment or through correct information, not only built trust in the process for attendees but bolstered the two-way dialogue.

North Kenner

Community snapshot: North Kenner

North Kenner, Louisiana is part of Kenner, a city located in Jefferson Parish. Kenner has a population of 64,007 people; 19.8% of the population is black and 60.2% is white.[3] The majority of the residents have a high school diploma (85.3%) and just over a quarter of the population (28.6%) have a bachelor's degree or higher.[25]

Kenner faces several environmental issues. Populations in North Kenner are at an elevated risk of cancer and respiratory hazard index; according to the air toxics measurements, the community is in the 95–100th percentile and the 90–95th percentile respectively. South of Kenner is the Mississippi River; consequently, most of the community is in the 95–100th percentile for flood risk. Because of its elevation and location, there are concerns Kenner will be considerably impacted by sea level rise, beginning at heights of one foot.[24]

Figure 7. The second roundtable location, is the North Kenner Library, part of the Jefferson Parish library system (https://www.jplibrary.net/north-kenner-library).

Roundtable: North Kenner

The North Kenner roundtable took place in the Jefferson Parish North Kenner Community Library (Figure 7). Meeting attendees represented a diverse set of ages, experiences, and perspectives. Attendees reported experience in academia, advocacy and non-profit, economic development, state government, and development.

When prompted to provide the first three words that came to mind when they heard carbon management, responses were more diverse than the first roundtable. Words provided by participants included: curious, alternative, sustainability, contradiction, NIMBY, and greenwashing. When prompted to share why attendees had provided their responses, some spoke about the opportunity for jobs that carbon management could provide, with some hesitancy around how those might manifest. Others hoped to better understand community impacts more broadly, for example, what “drilling holes in the ground and pumping stuff into them” could mean from an environmental perspective and how it might impact the community’s legacy of work with refineries.

In response to background information about carbon management, one attendee wanted to understand the mass-balance of electricity consumption at a facility when capture equipment was installed; did the new energy demand from the capture equipment become parasitic, and if so, what did that mean for the overall reduction in CO_2 emissions for the facility and project? Are ratepayers supplementing and incurring the cost of the power necessary for the carbon capture equipment? For injection sites, attendees were interested in understanding supply chain logistics, like where all the steel for pipelines comes from. Suspicion was raised that the United States would be able to source the volumes of steel necessary for proposed pipelines domestically. If local supply faltered, where would that steel come from? At the same time, who regulates the safety of pipelines? Lines of questioning like these quickly teased out the tension in the room of contrasting background knowledge levels around the mechanics of carbon management.

As the tool was presented, questions and comments after the demonstration focused on the usability of the tool, as well as the origins of some of the many data inputs. Comments sought to understand how some of the data, like air quality, were measured. For example, did the estimates of exposure to diesel PM2.5 come from automotive, rail, or something else? Attendees learned that estimates of air pollutant exposure are agnostic to origin and often are concentrated in certain areas away from the emission source. Others had data suggestions to include, like estimates of cancer prevalence by census tract measured; they offered to share the information after the meeting. Another not the importance of including oyster beds; in Louisiana, oyster beds are essential for all development considerations along the coast. This discussion helped clarify the weight local residents would give one metric compared to others, and the tool was subsequently updated to reflect this. The group also asked how the tool represented policy, for example, moratoriums or state policies, in the visual representation of ability or ease of siting a project.

Another conversation thread focused more on accessibility and cartographic design; attendees suggested improving the ability to see assorted colors, by increasing or decreasing opacity, or varying hues. The group further addressed the tension of data digestibility; what is the balance of including loads of information in case it is useful to community users, versus including so much that the tool becomes impossible to use? While no immediate resolution was provided, the group thought it over. Much of the conversation around the tool at the North Kenner meeting focused on ease of use and design of the tool, rather than the implications of its use. This was unlike the first roundtable conversation, which did provide direct feedback on the tool and instead focused more on how to communicate the tool’s functionality.

After providing feedback on the tool (Figure 8), attendees shared previous experiences with community engagement. Many discussed their experiences with bad engagement in carbon

management development and proposed projects, including one person who described a mandatory public meeting that was held over Zoom in the immediate aftermath of a natural disaster that had left significant portions of the community without power and thus without the ability to use Zoom; the project still considered engagement as having been done. Another told a story about a last-minute public engagement meeting that had been held, where even when community members showed up, the intent of the meeting was never revealed, and conveners refused to answer questions. Once again, the engagement box was considered to have been checked by project developers. Attendees reflected their hope that new projects would provide information well before the date of a public meeting to give community members time to review and prepare themselves with information before a meeting is held. They requested multi-lingual outreach materials to minimize language barriers. Both should be standard practice, though these strategies were not employed in previous engagement efforts.

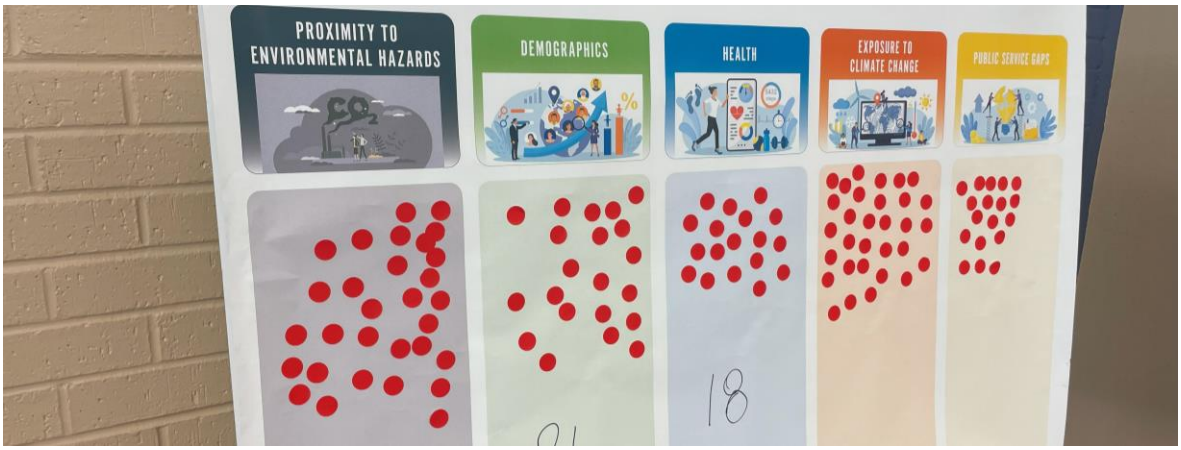

Figure 8. Results from the second roundtable exercise on how social factors in the decision support tool should be weighted.

The meeting ended with a general question or concern. With so much experience in the room from developments that had already been proposed in the local community, there was tension around the role of CCS in the state and region. So many facilities, participants felt, that were being proposed for carbon management were *new*. This was in direct conflict with the state's purported climate action goals, which were to leverage carbon management to decarbonize *existing* industries.

At the end of the roundtable, there were a tremendous number of suggestions provided around what could be done to improve public engagement around carbon management. Some were concrete requests, like a pipeline from dialogue to disclosures, more public meetings with question-and-answer forums, video information, a longer review period, and language flexibility. Other questions were based on how attendees felt that relationships had been removed from the engagement process, around elements of transparency, authenticity, honesty, and trust.

Key themes: North Kenner

1. **Grounding information in what is relevant to a particular location is critical.** During meetings like these roundtables, it's crucial to explain why we're having these conversations when providing background information on carbon management

technology. During the discussions, a recurring question kept coming up: *What does it mean for our community?* People wanted to understand the importance of various factors like pipeline needs, injection wells, electricity usage, and more. Attendees made it clear that they wanted to know how a project would directly impact their community. They wanted details like whether the local area would need to cover costs associated with the development, such as utility connections and maintenance expenses. These are the kinds of insights that neither the carbon management industry nor many project developers are readily providing. To make the introductory information about carbon management more effective, it's important to reshape the narrative. Every part of the introduction should revolve around the deeper "why"—why these topics matter to the community. This approach will better engage attendees and prepare them for the discussions that follow.

2. **Providing a common education and language for discussion can stimulate deeper conversation.** At the North Kenner roundtable, attendees' knowledge about carbon management varied. However, throughout the discussion, the language participants used to ask questions became increasingly more technical. Even though many aspects of the development process use specialized terminology, the attendees quickly grasped and incorporated new vocabulary into their discussions. Terms like "wellhead," "borehole," "compression," "composition," and "subsurface porosity" were learned and put to use during active conversations. This approach of introducing and adopting technical terms was effective at setting a common vocabulary for a room of diverse attendees and should be scaled across engagement formats.

3. **Poor initial engagement can increase the difficulty of doing engagement right, and thereby prevent future project development.** Some attendees at the North Kenner roundtable were new to conversations about carbon management, while others were not. Despite these differences, much of the conversation during the facilitated discussion was colored by attendees' encounters with what they considered to be inadequate community engagement in carbon management projects. These experiences left a strong negative impression. As a result, any future engagement efforts not only needed to be comprehensive on their own but also had the challenging task of undoing the negative perceptions from past poor engagements. These community experiences show that the entire carbon management industry suffers when one actor mishandles or omits authentic community engagement on a project. The opportunity to hold industry actors to a higher standard has not only arrived but is a necessity if the carbon management development landscape hopes to achieve anything close to the magnitude of deployment desired by state and federal policy actors.

Alexandria, Louisiana

Community snapshot: Alexandria

Alexandria is a city in Rapides Parish, Louisiana, with a population of 44,004. The majority of residents, 63.2%, are non-Hispanic white, and 29.2% of residents are black. The city is home to three universities and colleges, which are Central Louisiana Technical Community College, Louisiana State University-Alexandria, and Blue Cliff College-Alexandria.[25] A large proportion of the population, 84.9%, have at least a high school diploma, and 24.6% of the population have a bachelor's degree or higher education. [3]

In this community, the Red River goes along the outside of the city. As reported through EJScreen, Alexandria is at the 95-100th national percentile for high flooding risk and is in the 100-year flood plain of the Red River. [24] In terms of health risks, Alexandria is in the 95-100th percentile for air toxics cancer risk and the 80-90th percentile and air toxics respiratory HI. Many pollutant sources have been reported in Alexandria, including diesel particulate matter, lead paint, wastewater discharge, and hazardous waste, all of which fall in the 95-100th national percentile for this community relative to other parts of the country. [24] Approximately 18.4% of residents live below the poverty line in Alexandria, above the national average of 12.8%. The median earnings for men and women in Alexandria are $42,369 and $28,849, respectively. [25]

Figure 9. The third roundtable location is the Alexandria Library in Rapides Parish (https://www.rpl.org/index.php/locations/westside/).

Roundtable: Alexandria

The Alexandria roundtable took place in the Alexandria Library (Figure 9). At the beginning of the meeting, there were ten individuals in attendance, including students, community members, community leaders, state workers, industrial representatives, and local advocates.

During one portion of the introduction, not all community members were able to access the app to log their responses to the first word cloud activity, which led to attendees and facilitators helping folks to enter their information. Attendees often responded in multi-word phrases that were difficult to summarize, and also included words such as “boondoggle,” which the group helpfully paused to define, as well as words around safety, innovation, and climate. Attendees were engaged despite technical challenges, and most appeared interested in hearing one another’s perspectives.

At the beginning of this meeting, attendees had many questions for the meeting conveners, including their interest in carbon management, the association of this project with the Diamond Vault project, ties that any organization had to any political institutions, and the background and names of companies of all attending as observers. While this was not a heated discussion, there was clear tension in the room about the greater purpose that motivated this meeting—if there was one. After several presenters spoke and introduced themselves, the meeting continued.

After the introduction material, there were many questions. Many of these were technical in nature, such as whether carbon management in Louisiana was limited to use in enhanced oil recovery (EOR), why there was high geologic storage potential available in Louisiana, whether carbon management was driven by financial interests by oil companies, the differences between fracking and CO_2 injection, seismic risks, the profit margins if tax credits expire, how class VI wells might be different than abandoned oil wells, how methane emissions are related to storage and climate, whether tax incentives might change with a change as a result of presidential elections, and how this work relates to work completed by the Louisiana Climate Initiative Task Force. There was little animosity in these questions, but there was lots of curiosity and interest in why carbon management is important now, and what political, financial, and social issues may be driving the state and federal government’s policy decisions.

As the tool was presented, many people explored their own Census tracts or observed the presenter’s shared screen, projected at the front of the room. At least one audience member remarked just how much data were available, and how this was not only useful for carbon management but for other siting issues that lent themselves to looking at geospatial health data, such as burning trash.

When the participants broke into small groups to discuss which factors would be the most important in siting, many different opinions came to the fore regardless of what position each group was given. Some attendees had diverse levels of understanding of the process, which in some cases inhibited a deeper discussion of the consequences of carbon management. Several attendees shared anecdotes, such as:

- Difficulties of the storage project in Lake Charles/Lake Pontchartrain.
- The dichotomy between those who are pro-jobs and those who are anti-storage, regardless of additional information, especially within the context of the potential Diamond Vault project.

- Difficulty in getting information out to stakeholders due to a combination of lack of broadband, and low reading levels in the parish, making text-based outreach potentially less effective than in-person information.
- Uncertainty in the CO_2 emission futures in India and China, and the impact on their growth on emissions.
- Uncertainty regarding the amount the carbon storage might lead to reductions in other toxins, such as those from petrochemical facilities in cancer alley.
- The tension between CO_2 being a global problem and storage and air quality is a very local issue.
- General concern about carbon management perpetuating a system that is dependent on carbon and electricity.

Given the broad range of issues that were discussed both for and against carbon management during the day's sessions, there was broad acceptance of the usefulness of the tool for siting. The information was useful to attendees, and many spoke of things they didn't previously know were true about their area, such as health metrics or endangered species habitat. Having the same information readily available to all attendees helped make more fruitful discussions, and helped build trust that no information was being withheld.

Key themes: Alexandria

1. **Different background knowledge can impact everyone's contributions.** Although many attendees never stated their affiliations, a few did. Many of these attendees were from more technical or politically savvy backgrounds, such as a state employee, a student, or a member of the chamber of commerce. While not dominating any one conversation, these attendees tended to have stronger voices than other attendees.

2. **Official versus unofficial capacity of participants can inhibit conversations.** Several attendees publicly and voluntarily mentioned their previous or current work affiliations, indicating how this helped shape their opinions on carbon management. Participants seemed unsure if they were supposed to discuss their personal or professional opinions during this meeting. While these perspectives did not limit the discussion, it is unclear how much more some participants might have engaged if they understood whether they were participating as an individual, or as a representative of their employer.

3. **Difficulty of real-time data collection**. During some phases of this workshop, attendees were invited to submit answers online, and some attendees were not familiar with them. While this did not stop the discussions during this round table, the role of technology in these facilitated conversations, either in the form of familiarity with a geographical information system (GIS), the appropriate number of words to meaningfully contribute to a word cloud, or the universal accessibility of all reading materials, was more of an issue in these round table than others. In meetings with more people, potentially with larger differences in experiences in GIS or using apps in meetings, it would be helpful to have more people help those new to this technology, or use alternative ways of getting feedback.

Sulphur, Louisiana

Community snapshot: Sulphur

The city of Sulphur, part of the Calcasieu Parish, is home to 20,342 people. Of this population 90.2% are white, and 6.5% are black. Most of the population in Sulphur, 88.2%, have lived in the same house for more than one year. Unlike the other three communities, Sulphur does not have any higher education institutions in the city. Approximately 85.2% of residents have at least a high school diploma, and 15.3% of the population holds a bachelor's degree or higher education [25].

Sulphur has fewer environmental health concerns than the other community roundtable locations. Although Sulphur's location puts it at less risk of flooding, it is surrounded by communities that are within the 100-year floodplain. The city and surrounding areas are at the 95–100th percentile for cancer risk, and the 90–100th percentile for respiratory hazard index. Sulphur is not as severely affected by multiple pollutant sources as the other three communities. However, Sulphur is in the 95–100th percentile for a gap in the availability of broadband[24].

Figure 10. The fourth roundtable location is the West Cal Arena and Event Center in Sulphur, Louisiana (https://www.westcaleventcenter.com/gallery/).

Roundtable: Sulphur

The Sulphur roundtable took place at West-Cal Arena and Conference Center (Figure 10). As Franklin Associates began the meeting, a few attendees asked about the intention of the meeting. Unlike the meeting in Alexandria, where attendees wanted to know the background of every organization in the room, attendees were curious about whether this was to discuss a particular project, and if not, why they were asked to participate in evaluating a tool for a project that wasn't necessarily going to be built—this underscores how seldom communities are asked for input at the very beginning stages of planning rather than after projects had been announced.

During the beginning activities and presentations, attendees were generally attentive. One attendee in particular was not afraid to speak up, and often helped volunteer her perspective on things related to the environment, planning, and education. There were questions sprinkled in about GPI's role in deploying projects, how tax incentives worked, and who this would benefit companies or the state. Unlike previous meetings, where most participants stayed until the end of the meeting, at this roundtable, four participants left before the tool was reviewed. Two were mothers, and the only participants who attended any session with children, and two represented industrial organizations. While it's unclear how these individuals may have contributed to later discussions, it highlights that one challenge of roundtables is communicating to participants the value of their participation.

In the tool review sessions, while there weren't many questions, there were some discussions about the complexity of carbon storage. As people pointed to areas where there had been issues, such as Iowa and Mississippi, others emphasized that using the best technology available is critical to how a project works—in some cases, carbon storage or transporting CO_2 may not be the issue, but the age of the pipes, the kind of technology employed, or a project's commitment to safety. People seemed to not only find value in the information presented in the tool, noting that it could save those who needed to gather this information themselves a lot of time, but also that this information was on a map that allowed users to see values in both their area and the surrounding areas. Many attendees integrated their own local expertise with what they were seeing on a map, such as how oyster leases were protected areas and projects should not be sited.

A question about local assets in the community was one of the richest discussions of the day. When asked, "What local assets generate pride in your community?" what initially began as a positive list of natural features and local activities became a discussion about the legacy of industrial activities in the region. This included two distinct conversations, both relevant to how past industrial commitments can impact the current appetite for new industry. First, attendees acknowledged how important good jobs were to a region whose inhabitants are losing work in both fishing and the oil industry but countered that new businesses can bring more temporary construction jobs than long-term, well-paying jobs, and that sometimes this distinction is lost when a new company is thinking of locating in Sulphur. In addition, they acknowledge that if taxes and jobs were going to solve local issues, how had so many businesses come in but things had not gotten better? Second, three attendees, each with different but overlapping experience in training, education, business incubation, and local employment, shared the interrelated challenges in creating a healthy business and labor ecosystem in the parish, including:

- Perceived low level of education attainment of local students, inhibiting them from taking the best-paying jobs in local industries.
- Observations that many young people believe they can work in the local industry without realizing the increased job skills required for the best positions leave them earning less or out of this job market entirely.
- Lack of interest, understanding, and/or training by community members related to the opportunities to start their own small businesses as an alternative to relying on jobs in the industrial sector.

- A mismatch between what universities and colleges can offer that is still general enough to retain their state funding but specific enough to offer targeted job training to community members that would be most directly beneficial in gaining local employment.

As the tool review session ended, attendees also talked about transparency in siting. They considered the varying levels of education within the community and stressed the importance of using simple, understandable language in siting conversations. In addition, they stated their desire for industries siting in the state to be upfront and honest about all possible benefits, risks, and disbenefits. Attendees were specifically concerned about environmental impacts and the complexity of collaborating with local vendors in the absence of clear paths for small businesses to obtain licenses and insurance. They also highlighted the need for realistic predictions about the types of jobs that would be created if these industries were to be located in the area while considering the possible mismatch between the local education levels and the specific skills required for these jobs.

Key themes: Sulphur

1. **Past experiences with false promises of benefits can impact the acceptance of today's community benefits plans.** A careful message for those running roundtables in communities with a legacy of commercial or industrial projects is to be aware of past difficulties in the area. In this community, attendees' conversations showed that it would be especially important to not overpromise benefits; mistrust is easily and quickly sown, especially if initial promises are not delivered. Promising to work with disadvantaged, minority, or women businesses enterprises without acknowledging the status of the support programs to help launch these businesses will lead to under-promising commitments with local subcontractors and vendors. In addition, understanding how the needs of the industry have evolved is important, especially if a high school education is insufficient. There was insufficient local expertise to fill jobs, so they'd have to go elsewhere for hiring.

2. **The delicacy of sharing past injustices.** During this roundtable discussion, there were many discussions about some of the things a siting tool does not capture, such as the ongoing economic impacts of a plant location in a community, the enduring results of environmental justice issues, and decades of living in a state that contains, as attendees mentioned, "cancer alley." The line between listening session and tool evaluation is a difficult one, and both should ideally be addressed.

3. **Who should be involved in community feedback?** Attendees suggested the reading level of community members would be a barrier to active participation in siting meetings without accommodations in the language used, the reading level of materials, or the way input may be structured. The language and material did not appear to impede productive round tables discussions, but it's unclear without pre- and post-tests of participant understanding of carbon management how much knowledge each participant had coming into these sessions versus how much understanding they gained through direct participation. If this is expanding to a larger group of participants, this will need to be addressed.

Recommendations for roundtable meetings

The roundtable format had many advantages and provided an exciting opportunity to initiate directly with community members about carbon management technologies, unveil the decision support tool, and generate feedback for improving it. The aspects of roundtable engagement that were more successful included:

- **Employ skilled, local facilitators.** Cultivating a sense of trust with community stakeholders is an essential condition for a successful meeting. It is beneficial if the conveners and the facilitators are somewhat separate in the eyes of the community members and attendees. Facilitators should bring local expertise and a sense of familiarity, cultivating a space of understanding and opportunity to share perspectives and insights.
- **Compensate attendees.** It is important to acknowledge that participation and attendance at community engagement meetings require time commitment by participants. People are busy, with significant demands on their time. While compensation may come in different ways, monetary vouchers (either gift cards or cash payments) are usually ideal. Attendees should also be fed if the meeting occurs during a typical mealtime. While this practice is not unique to engagement in carbon management technologies, there needs to be recognition that discussing decarbonization initiatives is likely very low on people's list of priorities. Compensation should be adjusted to reflect that they are being asked to prioritize this when competing with very real pressures from work, family, or other commitments.
- **Clearly articulate engagement objectives.** It is important that at the first point of contact with any community member, including during outreach, and once again at the start of the meeting, the objective of the engagement is made clear. At multiple community roundtables, attendees expressed confusion or skepticism about the purpose of the meeting. Community members are frequently only engaged on a topic when there is a specific proposed project, or when permitting is required. In that same vein, it is important to be explicit about the motivations of the conveners and the facilitators and define the terms of the relationship that each is seeking to establish with community members. For example, is engagement meant to gather feedback on a decision support tool, is the state looking to gather insights from these conversations, is this part of a broader carbon management strategy development, or something else?
- **Provide background knowledge to attendees, including an overview of carbon management.** In addition to clear objectives, it is critical to ensure all community members have a minimum amount of the same information about carbon management, and that it is grounded in their community. For example, if a community has already experienced a permitting review process or engagement for carbon management development, background knowledge will look different from a comparative community that has no experience with the technology. At the same time, providing background knowledge ensures that there is some equalizing of context and knowledgebases for attendees in the room.
- **Ensure multiple pathways for feedback.** A singular roundtable or meeting is only one part of a broader engagement effort. To truly pursue authentic relationship-building and dialogue with the community, community members should be provided with multiple pathways for feedback. The feedback may be specific to the decision support tool, or it

may be more generic to carbon management technologies. Pathways for feedback or review could be electronic through the aid of an online survey or evaluation form or an e-mail contact. Feedback may be in the form of a written response, potentially administered immediately following or at the end of the roundtable, or it could be held as a follow-up conversation, either individually with attendees or as a group convening another time. Ultimately, the medium of feedback should be tailored to whatever is going to help attendees be most successful, and more importantly, feel that their input and the perspectives they provided remain true to the objectives of the roundtable.

- **Keep active communication channels open for content updates, ensuring accountability to conveners and facilitators.** Engagement is not complete after the meeting ends. Depending on the objective, both the conveners and facilitators are responsible to attendees to inform and update on how the information generated was ultimately incorporated into the objective or any deliverables, and how conveners are being held accountable for any next steps. There are many options for communicating updates to attendees and may include an e-mail follow-up, another convening, or a more formal website or virtual platform for dynamic updates. Maintaining a contact that attendees can reach out to directly also helps ensure that accountability feels two-way, and that attendees and community members have a clear method for engaging with the topic or deliverable as desired.
- **Strive for a representative attendance.** If facilitators are unable to reach community members with initial invitations, or if community members fail to attend, the conversation in roundtables can quickly lose dimension. A major benefit of multi-person roundtables is the ability for attendees to engage in dialogue with one another; this benefit is lessened when there are fewer people in the room, or when there is a lack of diversity in perspectives.
- **Match facilitation style to audience**. So much of the roundtable discussion rests in the hands of the facilitator. Introducing inconsistent facilitation could compromise the efficacy of the roundtable discussion. Sometimes different facilitation styles or even individual facilitators will resonate more with local community members. Due diligence to understand the appropriateness of the facilitator and local communities will help mitigate any risk of mismatch.

Broader Considerations for Carbon Management Engagement at Scale

Novel engagement through four roundtables across the state of Louisiana could not have come at a better time. More projects are seeking to engage communities in conversation about carbon management technology development than ever before. Critical questions about best practices and standards for engagement are being asked across the country right now.

As learned from the highly successful roundtables, a significant opportunity exists to scale and replicate the roundtable and decision support tool model. Given the number of communities where carbon storage projects are being actively pursued—there are pending Class VI well applications in Alabama, Arkansas, California, Illinois, Indiana, Louisiana, Mississippi, New Mexico, North Dakota, Ohio, Texas, and Wyoming—there is both the need and opportunity to develop best practices in community engagement across the country. These communities are likely the greatest candidates for employing roundtable discussions about carbon management technology development. For project developers, well-executed engagement will need to be integrated into the cost of doing business in carbon management. The risk of engagement done poorly is tremendous, as overcoming mistrust can be a much greater effort than taking the time to establish genuine relationships at the beginning. The risk of exploitative engagement and community burn-out is real; standards to help protect the time and capacity of communities, especially in high-pressure development areas like those identified as disadvantaged communities by federal designation, will be essential for the industry to define.

With all this in mind, carbon management at scale needs to prioritize consideration for **community readiness, strategic and sufficient timing, and appropriateness of engagement materials.**

Evaluate community readiness to prepare for strategic engagement

Communities have extraordinarily varied experience with carbon management technologies, both across different communities, and among individuals within a single community. These experiences mean that communities differ in their readiness to engage in visioning or decision-making around carbon management.

A community's readiness can be influenced by a variety of factors. Some communities may have specific qualities that make them more attractive to project developers, encouraging developers to actively choose those places. These communities might have already been sites of pilot projects or are locations where applications for projects or permits have been submitted. Readiness can also be informed by a community's willingness to initiate local development of carbon management technologies; these communities may be more likely to have existing knowledge about carbon management technology. Asking community-specific questions can help practitioners establish how ready a community may be for engagement in carbon management technologies. Some questions for project developers to consider are:

- **Does the community have climate action priorities, or have they articulated a desire to consider decarbonization technologies or climate action solutions?** Communities that have may be more likely to consider various types of carbon management as one tool in a suite of local climate solutions.

- **Does the community have a significant representation of emissions and energy-intensive industries? Alternatively, is the community defined as rural, or does the community disproportionately rely on fossil-based jobs for workforce and/or economic development needs?** These communities may perceive carbon management technologies as a mechanism to maintain local jobs, preserve local economic development, and/or mitigate harmful emissions.
- **Is the community located on or near geology that is well-characterized or considered good for geologic storage of captured CO_2?** These communities will likely face greater development pressure for carbon management technology providers earlier on than other communities.
- **Has the community already started to receive permitting or project applications for carbon management development?** Market pressures are already felt for these communities; here, local community members may uniquely be participating in engagement with existing perspectives on carbon management that will be disproportionately dependent on how existing projects have been managed.
- **Is the community defined as disadvantaged by federal designation?** As noted, these communities are uniquely eligible for federal funding and may face greater development pressures.

Focusing on opportunities across communities, however, provides a chance to intervene with information, start conversations, and time engagement to strategically align with the development pressures that communities may be facing.

Assess historical and local context with community readiness

Once established, readiness will impact many parts of engagement, including timing, who's involved, and preparation of outreach and education materials. If the engagement format or materials do not consider a community's readiness, it is less likely that engagement will be successful or accomplish outlined objectives. For communities with little readiness (e.g., no familiarity or appetite), poorly constructed engagement efforts could generate hostility towards the technology or cultivate mistrust in the process (which may also cultivate mistrust in the technology). For communities with higher readiness (e.g., experiencing development pressures or active interest in carbon management technologies), engagement that minimizes or ignores local context will neither advance community needs nor generate valuable insights. Information for communities with higher readiness is a more important currency in active conversations; couching everything in terms of why and how it impacts the community directly is essential.

In addition, any engagement must consider not only the local context specific to carbon management (such as proposed or awarded CarbonSAFE projects) but also be aware of other issues facing a community. Important local events, like historic environmental disasters, proposed private projects, and important local values or community characteristics (e.g., is it a primarily agricultural community, do many people rely on the local industry for jobs, etc.) are aspects of a community developers should understand early in project planning. The local regulatory and legislative context is also important; this varies tremendously from state to state and can have a significant impact on how much community members know about a project, and how much they may be expected to influence the project approval process. Some regulatory or policy language even defines the context of community or civic engagement, ranging from requirements on project developers, to components of permitting. As project planners begin

engagement with communities, it's important not only that work about the local context has been completed but that **every project spokesperson or facilitator in meetings or roundtables should be briefed on the local community context.**

Align engagement timing with community readiness

Finally, the notion of *when* to engage is essential to consider. To answer this question, we return to one raised prior: where does carbon management fall on the list of community priorities? If engaging early, carbon management is likely not at the top of the community's list of priorities. Engaging too late runs the risk that a community has already made up its mind.

Communities with high readiness are inclined to engage. Communities facing significant development pressure but who have not yet seen projects develop are perfect for roundtable conversations; they also need the roundtable conversations and the decision support tool, to facilitate active community dialogue in the development process and ensure that community members are empowered with sufficient information to engage in the development conversations.

Similarly, communities with lower readiness, such as communities facing fewer development pressures, are also good candidates for a roundtable conversation. Though these communities are further away from development, the extra time to learn and consider technology implications will only benefit the community.

For communities who have already seen a successful project, the conversation is different. It might be beneficial to have someone from the project at the engagement. Having a conversation too late, as in a community that has already experienced a project (and maybe it did not go well) is no longer a preliminary conversation.

Along with strategic timing, it is essential to allow sufficient time for engagement. The lived experience of community members must be central in the engagement dialogue; for many in conversations about carbon management, that lived experience involves a significant amount of hurt and past injustice. Space must be made to recognize this as part of the engagement dialogue. Negative past relationships with industry actors, as well as legacy experience with existing industrial sectors, complicate siting in some areas more than others. Because many who seek to benefit from carbon management technology deployment, and many who have ready money to invest now, are also those who are in the oil and gas industry, trust can be difficult to engender. Weaving trust in this complicated dynamic is difficult, and in some instances, may not be possible. In these cases, accepting that not everyone will agree is important, and a path to incorporate this into the discussion should be considered before engagement begins. However, these conversations take time. Ensuring that ample time is carved out in the engagement planning on the front end to make space for the conversations that the community wants or needs to have, will be critical to successful engagement.

Allow engagement to evolve

Even if all three dimensions of broader considerations are addressed, the conversation about engaging communities on carbon management technologies is inevitably and constantly evolving. Communities are becoming more experienced with carbon management technologies, and carbon management technologies are continuing to mature.

Some questions to consider:

- *Is it inefficient to conduct engagement individually for a technology when multiple technologies are being introduced to communities at the same time, or necessary to allow time to understand the risks and benefits of each technology?*
- *If carbon management is a portfolio of solutions and tools, should engagement leverage these overlaps?*
- *How can we get ahead of coordinating engagement to better use the time and resources of community members?*

As projects continue to develop and communities continue to change, continually and dynamically revising the needs for engagement, dialogue, and format will ensure that carbon management technologies deploy in a way that honors and empowers communities, while also ensuring that we can leverage the tools necessary to mitigate global CO_2 emissions and lessen the impact of climate change.

At each of the four roundtables held in Louisiana, a consistent format was utilized to share information, demonstrate the tool, solicit feedback, and stimulate discussion. While each roundtable differed insofar based on the experiences of each community, some common themes emerged.

- **Hiring a neutral, skilled, and local facilitator is essential to any successful engagement.** Good facilitators are familiar with the local norms, are more likely to have a deeper knowledge of a community's political and social dimensions, and perhaps more importantly, will remain in the community after engagement is completed. This allows for a level and trust and commitment to the community, rather than the cause or issue of the day, which is not always true for those who make one-time siting decisions.
- **The decision support tool offers a powerful way to share important information about siting carbon management technologies with communities. However, without two-way feedback to make the tool reflect community needs, along with communication and support about how to use it, the tool will not serve communities.** Numerous tools could be relevant to siting, in part because no single tool serves all purposes. For a tool to be used over a longer period, it must stay relevant. The user should have a way to improve it, test it with new scenarios, and update it with new information. Community members will also need guidance on how to use the tool.
- **Providing level-setting information is important for establishing common knowledge about technology, but is less useful when communities differ significantly in their level of familiarity with carbon management.** For any engagement, providing foundational level-setting and common language is critical. This will best serve the community when the information is framed in the local context. However, conversations where communities work in energy or industry look very different from conversations where people are hearing about something for the first time. Targeting meetings for different types of stakeholders, or different communication materials for various audiences, are two ways to integrate the needs of the local communities into engagement.
- **Engagement done poorly has lasting impacts and can impact the willingness of a community to come to the table in the future.** In meetings, several individuals brought up examples of engagement gone wrong, such as the outreach that resulted in a

moratorium on carbon sequestration in Lake Maurepas. In this case, many people knew about the project consequences before becoming familiar with the details of the project, potentially deterring many other carbon management projects in the area. Especially now, when so many projects are new, intentional community engagement is critical to getting more projects deployed.

- **Communities always have the right of refusal; if a technology is not right for them, a project may never move forward.** Developers, industry, and others need to be ready to face that reality, but also recognize that earnest, authentic, appropriate engagement can also be an avenue toward mutually beneficial outcomes for all involved. While some projects will inevitably move forward, for many, there can be no trust in a relationship when communities feel they must accept an outcome, regardless of how they feel.

Appendix: Decision Support Siting Tool

To begin the process of fostering community dialogue while also putting information into the hands of community members on carbon management technology deployment, GPI partnered with SWCA to develop a geospatial decision-making tool (Figure 11), the Louisiana Decision Support Tool, ("the decision support tool" or "the tool").[26]

The tool aims to provide a platform for stakeholders, broadly, to explore community, social, and environmental landscape data that might be important or of relevance as carbon management projects are being evaluated or proposed in Louisiana. It allows users to interface with data through an interactive story map, where layers of information can be turned on and off. The team spent considerable time distilling large volumes of information about siting and social factors into composite "scores," including a score for social factors, a score for environmental factors, and a composite score of the two. While the tool itself makes no judgment about whether it is good or bad to site something in one location over another, it allows users to investigate various dimensions of siting or locating a project within the state that they may be interested in better understanding.

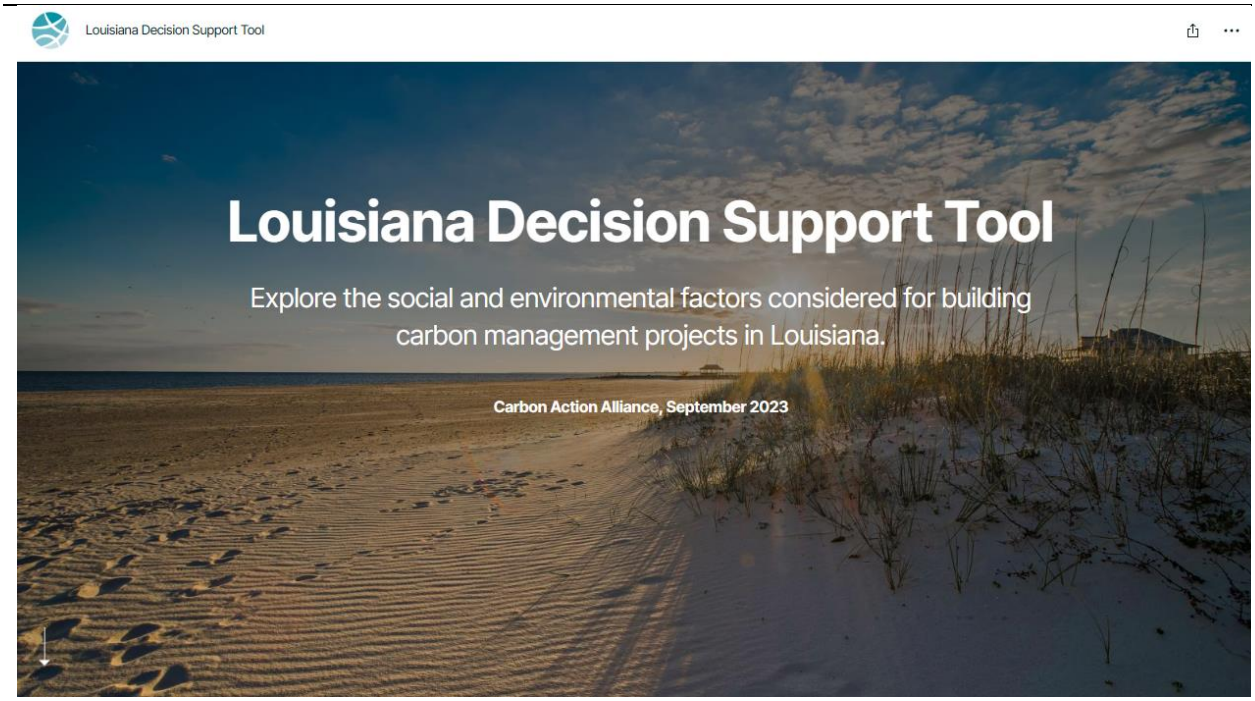

Figure 11. Louisiana Decision Support Tool webpage.[26]

The development of the tool itself was intentional and is meant to serve as a "home base" for education about carbon management with the complementary objective of being intuitive and easy for all Louisianans to understand. To accomplish this, the tool provides a text narrative throughout the story map format, wherein it explains the purpose and functionality of the tool. Some of the preliminary information includes foundational information on carbon management, including definitions, and local context specific to Louisiana's project development status. The story map includes a scoring methodology for the social, environmental, and the combined

factors, as well as how-to guides that are intended to help users leverage the full functionality of the mapping tool(s). The story map narrative includes recommendations for how the public can get involved with a project and future proposed CCS projects in their communities. Inside each interactive map, there is another User Guide to further explain the map layers, legend, and the display widgets, and a Data Descriptions and Sources tab that defines the categories and indicators for the user. [27]

Social factors map

The social factors map considers not only socio-demographic factors, such as race, ethnicity, or educational attainment, but also factors that could impact communities, like exposure to climate change; health impacts such as heart disease or asthma; proximity to environmental hazards; and public service gaps, like food deserts or Louisianans who are medically underserved.

For a multitude of reasons, compounding vulnerabilities associated with demographic factors increase the likelihood that certain types of development could cause disproportionate community harm. Some demographic factors, like age and race, result in vulnerability because of systemic inequities. In the United States, legacies of pollution or intentional community disinvestment have disproportionately targeted black and brown communities. Other social factors, like income, or existing health conditions, can exist separate from vulnerabilities associated with systemic racism and injustice. Yet they can also result in similar outcomes, notably where a community member is less ready to respond and recover from shock or trauma, and thereby where any introduced harm (say, in the form of poorly executed development) may have a greater relative impact.

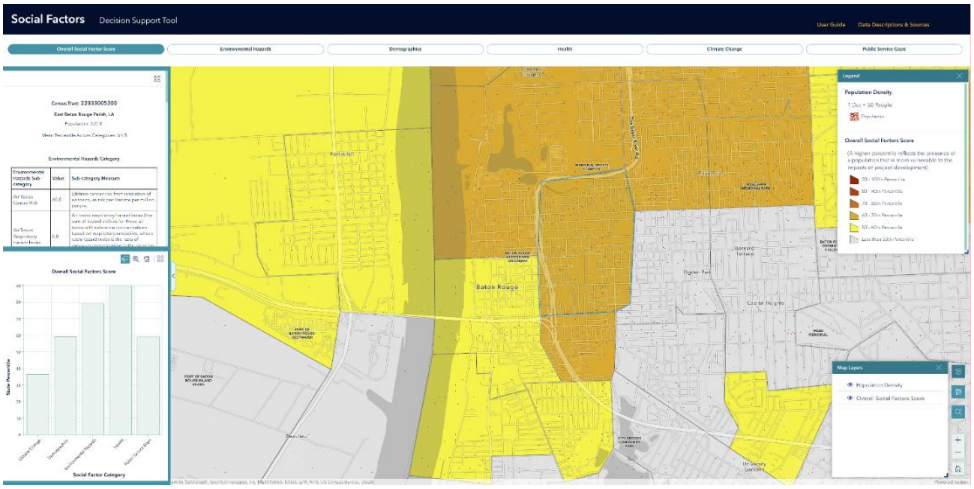

Figure 12. Screenshot from Social Factors map within the Decision Support Tool, zoomed in on East Baton Rouge Parish in Baton Rouge, Louisiana

The decision support tool summarizes the social factors at the census tract level, a national political boundary synonymous with the boundaries used to survey community members during the U.S. census. These areas are relatively small (when looking at the entire country), but they do have limitations as you zoom in to more local geographies like neighborhoods. Nonetheless, the social factors map allows users to see what percentile, across the metrics included, a given census tract falls. A census tract with a high percentile reflects the presence of a population that

may be more vulnerable to any negative impacts of project development. A census tract in a low percentile is likely at a lower risk of experiencing negative impacts from project development. An example is shown in Figure 12 for a census tract in downtown Baton Rouge, in East Baton Rouge Parish.

The full list of social data descriptions can be found online.[26]

Environmental factors map

The environmental factors included in the tool are more extensive, aiming to capture landscape-level dimensions, as well as wildlife, water resources, and the built environment. None of these inputs adhere to a neat, common geography. Instead, data input types varied significantly across the metrics included. To standardize the data, a score was calculated to illustrate the risk to environmental features from a potential carbon management project.

As the map describes, an area with a high environmental category score could require a longer or more extensive environmental permitting process, which corresponds to a higher level of protection prescribed by law or regulation. If the project were sited without considering social factors, areas with a low category score (a score of 1) would be considered as good opportunities for development to minimize the disturbance footprint on the landscape and reduce any potential negative impacts.

An example is shown in Figure 13 for a census tract in downtown Alexandria, in Rapides Parish. As noted, the data are summarized for the census tract of interest. For this example, most of the census tract received an environmental score of 2, indicating low to moderate risk for environmental considerations if seeking to site a carbon management project.

The full list of environmental data descriptions can be found online.[26]

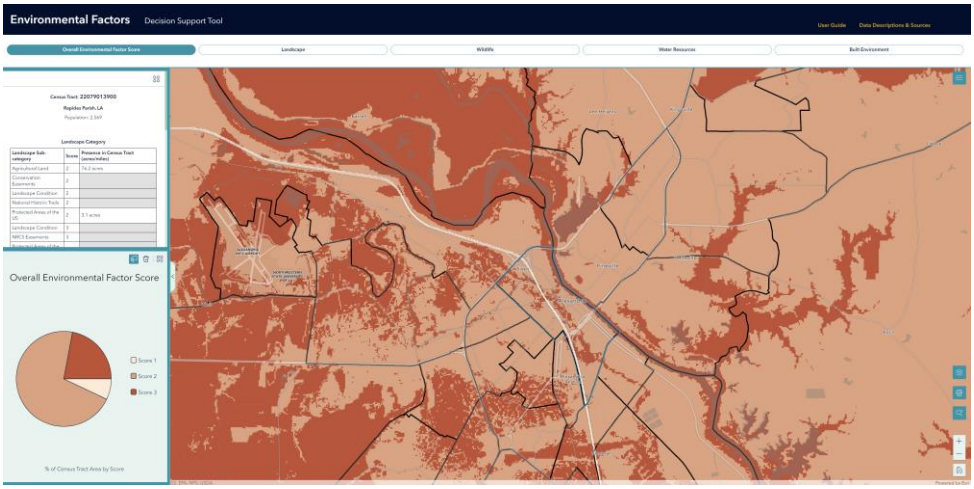

Figure 13. Screenshot from Environmental Factors map within the Decision Support Tool, zoomed in Alexandria in Rapides Parish, Louisiana

Composite (social and environmental) factors map

To find a way to standardize the social and environmental data into one view, the team developed a 10-square-mile hexagonal overlay across the entire state. Each hexagon is given a score across all factor inputs. For the composite factors map, a score of 50 or less indicates an area where there is less concern, across both social and environmental inputs, to siting a project. Concern for siting a project increases with the score. Figure 14 shows an example zoomed into the St. Charles, area outside of New Orleans.

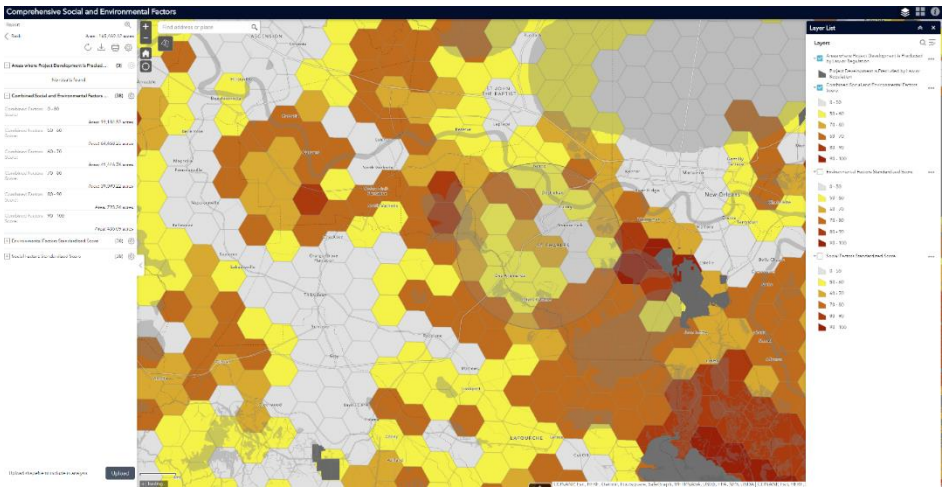

Figure 14. Screenshot from Composite Social and Environmental Factors Map, highlighting the hexagonal grid analysis done to combine the scores from the social and environmental maps, respectively. The map is zoomed in on an area just outside of New Orleans, Louisiana in the area surrounding St. Charles.

About Carbon Solutions

CARBON SOLUTIONS (carbonsolutionsllc.com) is a mission-driven small business focused on low-carbon energy Research & Development (R&D) and Software & Services. Energy applications include CCS, DAC, energy storage, geothermal energy, wind energy, the hydrogen economy, and energy equity. CARBON SOLUTIONS was launched in 2021 and currently has around 30 employees supporting more than 50 projects to date. In addition, CARBON SOLUTIONS has around 25 expert energy consultants that cover the entire CCS value chain, including legal, tax, and policy, corporate finance, project development and execution, engineering, and public outreach.

The company currently leads and participates in around a dozen DOE-funded R&D projects in a diverse range of areas, including CO_2 capture-transport-storage, energy storage, wind energy, geothermal energy, and next-generation carbon-negative power fueled by coal waste and biomass (carbonsolutionsllc.com/rd-projects). In addition, the company has multiple projects with non-profits and industry. CARBON SOLUTIONS' Software & Services division is focused on providing CCS software and solutions to help clients accelerate through to project execution (carbonsolutionsllc.com/software). The company has developed unique award-winning, industry-leading Software to understand, analyze, and support decisions for CO_2 capture, transport, and storage, including when, where, and how much CO_2 to capture and store, when and how to route CO_2 pipelines, and to assess economics across the entire CCS value chain.

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