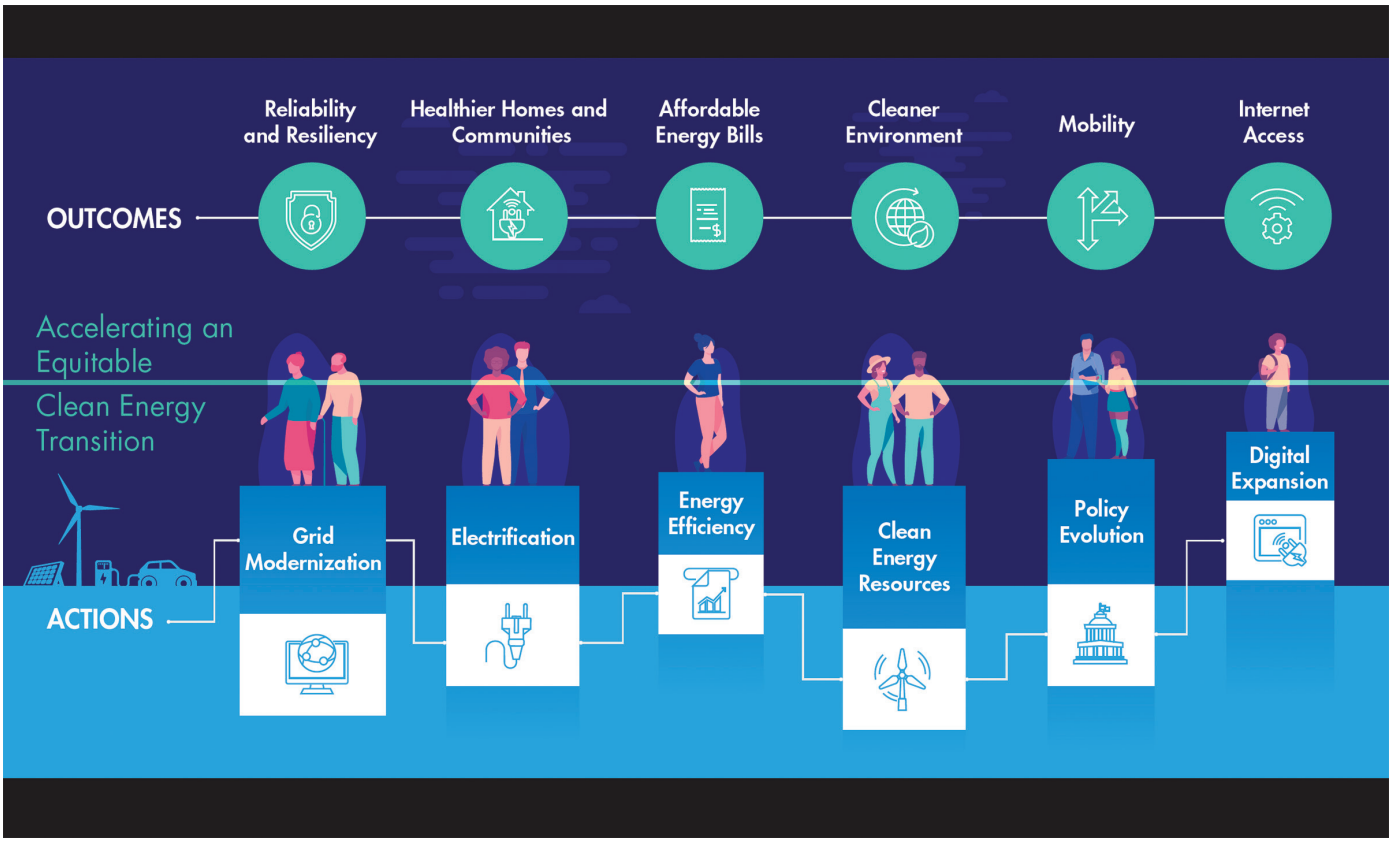
PROGRAM ON TECHNOLOGY INNOVATION: ENVIRONMENTAL JUSTICE AND CARBON CAPTURE AND STORAGE



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Key Insights

- Developing and deploying carbon capture and storage (CCS) at scale will require technological advancements and a buildout of retrofits and infrastructure. This advancement may also identify and address environmental justice concerns.
- Integrating environmental justice considerations into carbon capture and storage projects entails proactively ensuring that environmental justice communities meaningfully engage in project planning, development, and operations.
- Developing implementable risk mitigation strategies and community benefits that directly relate to the proposed project and that address community needs can facilitate a more successful project (e.g., implementing carbon capture technologies that further reduce other air pollutant emissions).
- Meaningful involvement is key to environmental justice and includes:
  - identifying potentially relevant affected communities
  - meeting with community-based organizations and key local leaders early in the process to understand the community's history, previous experiences, stresses, and aspirations
  - planning a proactive, meaningful engagement strategy based on this understanding
  - increasing community capacity with training, access, and local expertise
  - being prepared for changes, discoveries, and learning
  - showing flexibility in implementation and committing to integrity, transparency, disclosure, and follow through.

Introduction

Developing and deploying carbon capture and storage (CCS) at scale will require technological advancements and a buildout of retrofits and infrastructure. This project deveopment may also identify and address environmental justice concerns. This white paper provides an overview of environmental justice's implications and opportunities within CCS development, as well as leading practices that can support project development and operations.

For this paper, a literature review was conducted using key words/terms including *carbon capture and storage, carbon transport, carbon sequestration, subsurface injection, environmental justice, climate justice,* and *energy justice*. Additionally, because the fundamentals of environmental justice are not technology specific, this paper draws heavily on a recent EPRI publication titled "Environmental Justice and Renewables Energy and Storage" (3002024572).

Background

Recent research concludes that cost-effectively achieving economy-wide net-zero CO_2 emissions while maintaining reliable delivery of energy and energy services will require a broad set of low-carbon technologies, including renewable energy, nuclear, carbon capture and storage, bioenergy, and hydrogen.[1] In 2023, the United Nations (UN) Intergovernmental Panel on Climate Change (IPCC) will publish the full version of its Sixth Assessment Report. A key feature of this report evaluates feasible pathways to limit the average increase of the global temperature to 1.5°C above pre-industrial levels – a goal that will require a coordinated, global effort to completely transform the entire energy system. Among the assessed pathways that could keep global warming to below 1.5°C with "no or limited overshoot" (meaning they'd have a reduced chance of exceeding 1.5°C in the near term), there is a broad range of possible CCS technology deployment options, capturing and storing a cumulative median average of 665 gigatons (Gt) of carbon dioxide between now and 2100.[2] Even the "Illustrative Mitigation Pathway," based on a particularly high uptake of renewable energy, still requires an-

1 "LCRI Net-Zero 2050: U.S. Economy-Wide Deep Decarbonization Scenario Analysis." EPRI, Palo Alto, California (2022). Accessed at https://lcri-netzero.epri.com/en/conclusion.html.

2 Bright, Matt and Toby Lockwood. "What does the latest IPCC report say about carbon capture?" Clean Air Task Force (2022). Accessed at https://www.catf.us/2022/04/what-does-latest-ipcc-report-say-about-carbon-capture/.

Table of Contents

Key Insights....2
Introduction....2
Background....2
Environmental Justice Overview....3
Potential Environmental Justice Issues Associated with CCS....5
Environmental Justice and Project Development....7
Conclusion....10
References....11

nually capturing and storing more than 3 Gt of carbon dioxide by 2050 (Figure 3.15 in the full report).

Recently enacted U.S. legislation provides billions of dollars in funding for research activities, demonstration projects, and tax incentives that could accelerate the development and deployment of CCS technology. Additionally, to support these ambitious goals, the White House Council on Environmental Quality (CEQ) published a report and guidance about carbon capture, utilization, and storage (CCUS).[3] State and local actions on CCUS are also evolving. California recently passed the "Climate Crisis Act," which includes developing unified CCUS permit applications, while also banning the use of captured CO_2 for Enhanced Oil Recovery.[4] The New Orleans City Council has also recently banned similar operations, citing numerous environmental justice concerns including storage safety risks.[5]

For decades, EPRI's Generation Sector has been investigating emerging and advanced technologies for capturing carbon dioxide (CO_2) from post-combustion flue gas.[6] This information, which includes EPRI's 2021 update[7] on post-combustion carbon capture as well as additional work supporting CO_2-capture research, is available through EPRI's Program 222, EPRI's Technology Innovation (TI) program, EPRI's Low Carbon Resources Initiative (LCRI), projects funded by the U.S. Department of Energy (DOE), and EPRI supplemental projects.

While not a focus for this paper, there is some debate about whether to pursue carbon capture. Economic and systemic modeling from the International Energy Agency (IEA) and IPCC shows that carbon capture is necessary to achieve deep levels of decarbonization at lower cost to society.[8]

Some scholars focused on justice and climate change observe that emissions-mitigation strategies closely interconnect with our social and economic systems, and can include systemic wealth, and racial and gender inequities.[9] A potential concern with CCS is that technologies will "shift the attention of the public, of economic enterprises, and of political decision-makers away from the reduction of greenhouse gas emissions and toward [its] use."[10] In the study of climate change, many scholars refer to this concept as "mitigation deterrence" to describe solutions that may deter or delay other climate change mitigation.[11]

Environmental Justice Overview

For the purposes of EPRI's research, "Environmental Justice" (EJ) refers to fair treatment and meaningful involvement regarding environmental impacts and access to environmental benefits; "Equity" means fair treatment in how benefits and burdens are distributed throughout society and meaningful involvement regardless of ability, race, or socioeconomic status; and "Energy Equity" stands for affordable and fair access to energy services and benefits and involvement in related decision-making. Integrating environmental justice considerations into CCS projects entails acting proactively to ensure that environmental justice communities are meaningfully engaged in project planning, development, and operation. This includes developing implementable risk mitigation strategies and community benefits directly related to the proposed project and predicated on community needs.[12] Pursuing environmental justice involves several specific aspects of the wider understanding of justice:

- **Procedural justice** deals with the fairness and transparency of the processes that allocate resources, and is concerned with making and implementing decisions according to fair processes, with transparency and impartiality and a focus on inclusive and authentic engagement.

3 "CEQ Issues New Guidance to Responsibly Develop Carbon Capture, Utilization, and Sequestration." The White House (2022). Accessed at https://www.whitehouse.gov/ceq/news-updates/2022/02/15/ceq-issues-new-guidance-to-responsibly-develop-carbon-capture-utilization-and-sequestration/.

4 Lopez, Nadia. "California approves big climate change steps – but one ambitious one fails." Cal Matters (September 16, 2022). Accessed at https://calmatters.org/environment/2022/09/california-climate-change-legislature/.

5 Resolution No. R-22-219, New Orleans City Council, 2022–2026. New Orleans, Louisiana (2022). Accessed at: https://cityofno.granicus.com/MetaViewer.php?view_id=42&clip_id=4102&meta_id=584901.

6 Booras, G.S. and S.C. Smelser. "An Engineering and Economic Evaluation of CO_2 Removal from Fossil-Fuel-Fired Power Plants." *Energy*, 16, pp. 1295–1305 (1991). Accessed at https://doi.org/10.1016/0360-5442(91)90003-5.

7 "Post-Combustion CO_2 Capture Technology Development: 2021 Update." EPRI, Palo Alto, California (September 29, 2022). 3002022091

8 "LCRI Net-Zero 2050: U.S. Economy-Wide Deep Decarbonization Scenario Analysis." EPRI, Palo Alto, California (2022). Accessed at https://lcri-netzero.epri.com/en/description-intro.html and https://www.catf.us/2022/04/what-does-latest-ipcc-report-say-about-carbon-capture/.

9 Sultana, F. "Gendering Climate Change: Geographical Insights," *The Professional Geographer* 66:3, pp. 372–381 (2014).

10 Merk, Christine; Gert Pönitzsch; Katrin Rehdanz. "Do climate engineering experts display moral-hazard behaviour?" *Climate Policy* 19(6):1–13 (2019). 10.1080/14693062.2018.1494534

11 Markusson, Nils; Florian Kern; Jim Watson. "Assessing CCS viability – A socio-technical framework." *Energy Procedia*, 4. 5744–5751 (2011). 10.1016/j.egypro.2011.02.570.

12 "Environmental Justice and Renewable Energy and Storage," EPRI, Palo Alto, California (2022). 3002024572

- **Distributive justice** is about the fairness in the distribution of benefits and burdens across all segments of a community or society, including the allocation of rights, resources, or information. It also pertains to economic justice and members of society getting a "fair share" of available benefits and resources.
- **Recognition justice** involves understanding historical, cultural, and institutional factors as well as respecting peoples' assumptions, values, and knowledge. It is important to recognize that historical and other issues may still impact these communities in ways that may include redlining, underinvestment, disenfranchisement, and exclusion from decision making.
- **Intergenerational justice** pertains to decision-making around aspects that should be maintained or changed in ways that consider obligations to future generations. Actions that increase rather than limit the development options for future generations can be said to improve intergenerational equity.

Environmental justice considerations arise from a variety of sources: federal, state, and local requirements and policies, as well as corporate and investor commitments. Considering EJ communities' rights, needs, and requests is also good professional practice and should help minimize common risks such as local resistance of energy projects.

Federal policies require agencies to identify and address disproportionately high and adverse effects their programs, policies, and activities might have on minority and low-income populations.[13] Federal permitting requirements may incorporate environmental justice analysis under the National Environmental Policy Act (NEPA), as agencies consider the environmental and related social and economic effects of their proposed actions. To comply with NEPA criteria, agencies are required to identify disproportionately high and adverse human health and environmental effects to low-income, minority, and tribal populations as well as possible mitigation measures.[14]

Additionally, under Title VI of the Civil Rights Act, federal agencies must ensure that recipients and subrecipients of federal financial assistance (including states, municipalities, and other public and private entities) comply with federal civil rights laws that prohibit discrimination on the basis of race, color, national origin (including limited English proficiency), disability, sex, and age.[15] This includes projects that receive federal grants and loans, incentives, and other types of federal funding.

The U.S. Environmental Protection Agency (EPA) has also identified opportunities where it can advance environmental justice through its statutes, civil rights laws, and implemented regulations.[16] For example, EPA has identified opportunities to advance environmental justice through New Source Review preconstruction permitting under the Clean Air Act for major sources of air pollution or major modifications of new sources, by:

- extending public comment periods
- holding multiple hearings
- providing translation services in public meetings in areas with limited English proficiency
- inviting community groups to meet with officials prior to the development of a draft permit.[17]

Additionally, among other things, "EPA has authority under 40 C.F.R. part 7 to ensure recipients'[of EPA financial assistance] siting decisions do not have a discriminatory effect based on a protected status."[18]

Some states have also enacted environmental justice laws or included environmental justice provisions in state laws that might be applicable to permitting programs. Nearly a dozen states apply such standards to some of their programs, and environmental justice considerations may be considered even under pre-existing siting and permitting laws.[19] For example, Virginia set a goal to ensure that "development of new, or expansion of existing energy resources or facilities does not have a disproportionate adverse impact on economically disadvantaged or minority communities."[20] The U.S.

13 Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," 59 Fed. Reg. 7629 (1994). https://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf.

14 "Environmental Justice Guidance Under the National Environmental Policy Act." Council on Environmental Quality (1997). https://www.epa.gov/sites/default/files/2015-02/documents/ej_guidance_nepa_ceq1297.pdf.

15 42 U.S.C. 2000d et seq.; "EPA Legal Tools to Advance Environmental Justice."

16 "EPA Legal Tools to Advance Environmental Justice," U.S. Environmental Protection Agency (May 2022). https://www.epa.gov/system/files/documents/2022-05/EJ Legal Tools May 2022 FINAL.pdf; "Environmental Justice and Civil Rights in Permitting FAQs," U.S. Environmental Protection Agency (August 2022). https://www.epa.gov/system/files/documents/2022-08/EJ%20and%20CR%20in%20PERMITTING%20FAQs%20508%20compliant.pdf.

17 Ibid.

18 Ibid.

19 Gerard, Michael B.; Edward McTiernan. "Emerging State-Level Environmental Justice Laws," *New York Law Journal*, Vol. 265, No. 91 (May 13, 2021). https://climate.law.columbia.edu/sites/default/files/content/NYLJ05122021492784Arnold.pdf.

20 Va. Code Ann. Section 67-102(A)(11).

Court of Appeals for the Fourth Circuit recently applied Virginia's existing air pollution law and these provisions to find that the state had failed to adequately analyze the potential impacts of a natural gas pipeline compressor station on a community of color in which the facility was to be located.[21] Similar concerns may arise for siting and the location of other facilities requiring state permits and even for facilities that do not require federal or state permits.

Federal and state grant and tax credit programs also drive some environmental justice concerns. For example, the 2022 federal Inflation Reduction Act (IRA) provides investments in the form of tax credits and grants to accelerate the transition to clean energy and reduce emissions.[22] Executive Order (EO) 14082, "Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022," establishes that the IRA sets out to "improve public health and advance environmental justice and economic opportunity for frontline communities who disproportionately bear the brunt of cumulative exposure to industrial and energy pollution."[23] Agencies implementing the law are to prioritize "promoting construction of clean energy generation, storage, and transmission, and enabling technologies through efficient, effective mechanisms that incorporate community engagement."[24] CEQ's guidance describes expected community engagement and Tribal consultation, and includes:

- developing robust stakeholder engagement plans
- avoiding the imposition of additional burdens on overburdened and underserved communities
- ensuring transparency and accountability for applicable mitigation.[25]

Potential Environmental Justice Issues Associated with CCS

CCS and its risks and benefits vary across populations and communities, and education will likely be necessary to fully understand it.[26] Potential concerns about CCS span the capture, transportation, and storage of CO_2, as well as the extended use of infrastructure and implicated energy types. Additionally, CCS may disproportionately impact people who have been historically burdened with environmental justice issues pertaining to legacy and operating industrial facilities. Common issues that may be related to CCS development and operations include:

- **Property values**. Homeownership is a significant source of wealth and security for many people, and in many environmental justice communities it may constitute people's only meaningful asset. Some EJ communities may perceive a proposed energy facility as another instance in a long history of discrimination that prevents access to the fullest benefits of homeownership, and the prospect of a local use potentially depressing values may raise issues of exploitation or sacrifice zones in areas where industrial land uses are prevalent.

  There may also be concerns about storage inducing seismic activity and consequent leakage. An EPA report notes that improper injection "could raise pressure in the formation, and if too high, injection pressure could 're-activate' otherwise dormant faults, potentially inducing seismic events."[27]

- **Public health**. Environmental justice communities may already face disproportionate environmental health burdens. It is important to consider these factors even though they may seem negligible. This includes the changes in external environmental conditions that may raise community concerns. For example, communities may worry about possible respiratory impacts from construction, transportation, and operations. Concerns may include accidental releases of pollutants and what the

21 "Friends of Buckingham v. State Air Pollution Control Bd.," 947 F. 3d 68 (4th Cir. 2020). Available at: https://cases.justia.com/federal/appellate-courts/ca4/19-1152/19-1152-2020-01-07.pdf?ts=1578427219.

22 "Summary of the Energy Security and Climate Change Investments in the Inflation Reduction Act of 2022." https://www.democrats.senate.gov/imo/media/doc/summary_of_the_energy_security_and_climate_change_investments_in_the_inflation_reduction_act_of_2022.pdf.

23 Section 1(d), E. O. 14082 "Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022," 87 Fed. Reg. 56861 (September 12, 2022). https://www.federalregister.gov/documents/2022/09/16/2022-20210/implementation-of-the-energy-and-infrastructure-provisions-of-the-inflation-reduction-act-of-2022

24 Section 2(d), E. O. 14082 "Implementation of the Energy and Infrastructure Provisions of the Inflation Reduction Act of 2022," 87 Fed. Reg. 56861 (September 12, 2022). https://www.federalregister.gov/documents/2022/09/16/2022-20210/implementation-of-the-energy-and-infrastructure-provisions-of-the-inflation-reduction-act-of-2022.

25 "CEQ Guidance and Executive Orders Related to Native Americans," National Environmental Policy Act (2022). https://ceq.doe.gov/get-involved/tribes-and-nepa.html.

26 Tcvetkov, Pavel; Alexey Cherepovitsyn; and Sergey Fedoseev. "Public perception of carbon capture and storage: A state-of-the-art overview," *Heliyon*, 5 (2019). https://doi.org/10.1016/j.heliyon.2019.e02845.

27 40 CFR Parts 144 and 146 "Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells; Proposed Rule," Environmental Protection Agency, section 43498 (July 25, 2008). chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.govinfo.gov/content/pkg/FR-2008-07-25/pdf/E8-16626.pdf.

emergency response would be even when there are processes and technology to prevent leakage, including seismic and satellite imaging, pressure sensing, and groundwater monitoring.[28] Lastly, there may be concerns about ongoing and cumulative impacts from an existing pollution source even after it is retrofitted with carbon capture technology. As a strategy to extend the life of emitting facilities, carbon capture by amine scrubbing can significantly reduce the effect of power plant emissions on ambient levels of PM2.5. With coal-fired power plants, amine scrubbing can significantly reduce SO2 emissions. SCR will usually minimize NOx emissions in both gas and coal fired plants.[29]

CO_2 storage may also raise concerns about safe drinking water supply. According to the EPA, CO_2 injected into the subsurface can mix with water in the formation fluids of geologic structures. This creates carbonic acid, which can impact water quality, and may "acidify formation waters potentially causing leaching and mobilization of naturally occurring metals or other contaminants…CO_2 may also release contaminants into solution." The CO_2 stream can also contain impurities such as hydrogen sulfide, sulfurous and nitrous oxides, and co-contaminants may also be dangerous if they perforate drinking water sources.[30] Further, injected CO_2 may contain other pollutants derived from its source, posing additional risk for contamination.[31]

- **Cultural, historic, or religiously important sites**. Communities may object to a project development because of the site's significance or how it might be affected by the development. Installing a pipeline or storage installation on a site that is sacred or culturally important for indigenous peoples, or in a way that impedes access to such a site, may face opposition from affected tribes and members. A project site located in an area where a sensitive event occurred, such as sites of historic violence and injustice, could generate objections from survivors or the descendants of those affected. While the site itself may not have special status, environmental justice communities may also have concerns if the proposed site use interferes with other significant values.

- **Water scarcity.** Because of energy penalty and cooling duty, CCS powerplants withdraw water at rates that are 25–200% higher than non-CCS powerplants, and they may shut down periodically due to water scarcity.[32] Some studies indicate, however, that consumption rate may significantly decrease when using CO_2 enhanced water recovery. Still, water security varies across geographies, and increasing water withdrawals could have economic and environmental impacts.[33]

- **Present and future generations.** While CO_2 storage has been studied extensively over the past five decades, with findings indicating a low risk of leakage[34] and high confidence in modern monitoring techniques,[35] justice advocates assert that companies responsible for CO_2 storage must oversee sites so as not to burden future generations. Numerous states have adopted laws transferring liability to state governments after a certain amount of time following site closure, and federal regulation requires that geological storage site identification and engineering processes include risk minimization to reduce the chance of leakage[36]; however, disenfranchised and under-resourced communities may question the efficacy of these requirements.

- **Prolonging the impacts of polluting facilities.** Inequities may be particularly severe due to "clustering," which is regarded as a critical strategy for building out CCS, taking "advantage of the

28 "Negative Emissions Technologies and Reliable Sequestration: A Research Agenda," *The National Academies Press*, National Academies of Sciences, Engineering, and Medicine, Washington, DC: (2019). https://doi.org/10.17226/25259.

29 Rochelle, Gary T. "Amine scrubbing for CO_2 Capture," *Science* Vol. 325, Issue 5948 (September 25, 2009). DOI: 10.1126/science.1176731.

30 40 CFR Parts 144 and 146 "Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO_2) Geologic Sequestration (GS) Wells; Proposed Rule," Environmental Protection Agency, section 43497 (July 25, 2008). chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.govinfo.gov/content/pkg/FR-2008-07-25/pdf/E8-16626.pdf.

31 Fogarty, J.; M. Mccally. "Health and Safety Risks of Carbon Capture and Storage," *JAMA* 303 1, pp. 67–68 (2010). DOI: 10.1001/jama.2009.1951.

32 "Sixth Assessment Report," IPCC, chapter 6, pp. 6–39 (2022). https://www.ipcc.ch/assessment-report/ar6/.

33 Rosa, L.; J.A. Reimer; M.S. Went; P. D'Odorico. "Hydrological Limits to Carbon Capture and Storage," *Nature Sustainability* 3, pp. 658–666 (2020). https://www.nature.com/articles/s41893-020-0532-7.

34 Batres, Maya; Frances Wang; Holly Buck; Rudra Kapila; Ugbaad Kosar; Rachel Licker; Deepika Nagabhushan; Ester Rekhelman; Vanessa Suarez. "Environmental and climate justice and technological carbon removal." *The Electricity Journal* 34. 107002 (2021). 10.1016/j.tej.2021.107002.

35 Furre, Anne-Kari. "20 Years of Monitoring COx-injection at Sleipner," *Energy Procedia* Volume 114, pp. 3916–3926 (July 2017). https://doi.org/10.1016/j.egypro.2017.03.1523.

36 Roberts, Jennifer and Linda Stalker. "What Have We Learnt about CO_2 Leakage from CO_2 Release Field Experiments, and What Are the Gaps fort the Future?" *Earth Science Reviews* Vol. 209 (October 2020). https://www.sciencedirect.com/science/article/abs/pii/S0012825218304264.

fact that around the world, many emissions-intensive facilities (both industrial and power) are located in tight geographical clusters."[37] Existing energy and industrial infrastructure are often situated in poorer areas and in communities of color,[38] prompting concerns of procedural and distributive justice.[39]

Environmental Justice and Project Development

Environmental Justice Communities

In determining how and whether to apply environmental justice practices to a project, it helps to define the communities and community settings where these practices may be expected, required, or particularly useful. Each project, like the communities the project will impact, is likely to have unique characteristics and issues, and the following describes how to identify and engage these communities.

Relevant communities can be identified using socio-demographic characteristics. Among these factors are the extent to which a defined community or population can be characterized as:

- low-income
- having linguistically isolated/fewer speakers of English
- having fewer years of education than the national average
- having a high unemployment rate
- experiencing historic loss of employment/employers
- experiencing a preponderance of poor health indicatorsexperiencing lower life expectancy rates than the national averagehaving lower median home values than typical to the region
- having a meaningful number of Black, indigenous, and/or people of color (BIPOC) residents.

Additionally, environmental characteristics may also suggest environmental justice concerns in the community, including substandard housing conditions (lead paint, lead water service lines, lack of energy efficiency, poor construction/maintenance), high pollution exposure burdens, proximity to waste facilities, deficits in public services/public infrastructure, and vulnerability to flooding, climate change, or other environmental hazards.

Federal practices, which may be seen as leading practices, for identifying communities, screening, and assessing impacts could be relevant to an organization, particularly if that organization is involved in any federal actions, such as obtaining a federal permit or participating in a federal grant project. The Office of Management and Budget's (OMB) interim definition of "disadvantaged communities" describes "community" as "either a group of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals where either type of group experiences common conditions," and bases the concept of "disadvantaged" on a combination of variables including low-income or persistent poverty, high unemployment or underemployment, racial and ethnic segregation, linguistic isolation, and substandard housing.[40] EPA's EJSCREEN (and the forthcoming Climate and Economic Justice Screening Tool) is a web-based mapping tool that may help identify minority and low-income populations and potential environmental quality issues.[41] Additionally, several states have screening or mapping tools that can help identify disadvantaged and overburdened communities.[42] As these tools continue to evolve, it will be necessary to research the jurisdiction(s) potentially involved in a project at the project outset.

Undertaking Meaningful Involvement

Meaningful engagement with communities can take many forms. Appropriate engagement techniques include a range of actions, and different techniques may be best suited to various stages of a project.[43] Familiar strategies for consultation with a community include

37 "Global Status of CCS: Special Report – Understanding Industrial CCS Hubs and Clusters," Global CCS Institute (June 2016). https://www.globalccsinstitute.com/wp-content/uploads/2019/08/Understanding-Industrial-CCS-hubs-and-clusters.pdf.

38 Muffett, Carol. "The Opportunities and Risks of Offshore Carbon Storage in the Gulf of Mexico," testimony before the U.S. House Committee on Natural Resources Subcommittee on Energy and Mineral Resources (April 28, 2022). https://naturalresources.house.gov/imo/media/doc/Muffett%20-%20Testimony%20-%20EMR%20Ovr%20Hrg%204.28.22.pdf.

39 McLaren, D.; K. Krieger; K.Bickerstaff. "Justice in energy system transitions: the case of carbon capture and storage." In K. Bickerstaff, G. Walker, and H. Bulkeley (Eds.). *Energy justice in a changing climate: Social equity and low-carbon energy* (pp. 158–181). London: Zed Books Ltd (2013). Accessed July 8, 2022 from http://dx.doi.org/10.5040/9781350219908.ch-009.

40 "Interim Implementation Guidance for Justice40 Initiative." Executive Order of the Office of the President, Office of Management and Budget (July 20, 2021). https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf.

41 "EJScreen: Environmental Justice Screening and Mapping Tool." United States Environmental Protection Agency (2022). https://www.epa.gov/ejscreen.

42 "Additional Resources and Tools Related to EJScreen," U.S. Environmental Protection Agency. Accessed at https://www.epa.gov/ejscreen/additional-resources-and-tools-related-ejscreen.

43 See, e.g., "Community Guide to Environmental Justice and NEPA Methods (Characteristics of Meaningful Engagement)," Environmental Justice Interagency Working Group, p. 12 (May 22, 2019). https://www.energy.gov/nepa/downloads/

public comment periods, focus groups, community forums, and surveys. These types of strategies may be useful to acquire a basic understanding of a community in the initial stages of a project. As a project progresses, deeper involvement and collaboration with a community may include strategies such as house meetings, interactive workshops, polling, community forums, memorandums of understating with community-based organizations, citizen advisory committees, and participatory budgeting.[44]

Even if the community has not been involved at the earliest stages of planning, it is important to start meaningful engagement as soon as possible, as this can still help lead to positive outcomes. McLaren et al. (2013) note that consideration of procedural justice can help ensure distributive justice, and they propose a "whole-systems perspective" that accounts for the entire lifecycle of the technology, involves the public early on, allows community members to help establish the terms of their participation, and accounts for stakeholders across spatial and temporal boundaries. Procedural justice issues linked to stakeholder involvement in CCS may include lack of knowledge and access to information.[45] [46] [47]

Regardless of the types of engagement utilized, there are several leading practices for community engagement, including:

- *Early consultation that is active, not reactive nor pro-forma.* Proactive consultation generates early awareness of potential concerns which in turn allows developers to devise specific solutions.
- *Understanding which community member/s may have useful or important information.* Identify individuals who may have knowledge, as well as the respect of their communities. Coordinate with community-based organizations and develop a community profile together with such organizations.
  - "The community profile can be developed in collaboration with the community in a two-way dialogue. The community's level of participation, interest, and understanding could be affected by literacy levels, numeracy levels, or disabilities, which might not show up in aggregated census or health data. It could be discoverable through direct engagement with community groups; however, it is important to know when a community prefers oral as opposed to written communication as well. It is also important to achieve a solid understanding of the community's perception of the benefits and costs of participating."[48]
- *Listening in order to learn.* It is not safe to make assumptions about a community or what its concerns may include. For example, when working with a community of a different cultural background, let that community explain how its culture or history has shaped possible concerns about a project. This will help avoid assumptions that either overlook a community's actual concerns or attribute concerns that do not actually exist within that community.[49]
- *Planning meaningful engagement that includes follow-through, determining whether objectives are being met or whether the plan itself needs to be modified in order to be effective.* For example, California's Department of Public Health advocates "planning for community participation by drawing on evidence-based guidelines that inform the remaining goals" to achieve a defined purpose.[50]
- *Formatting and designing interactions that are based on the local community and that ensure accessibility.* Accessibility and inclusiveness encompass a variety of practices. This includes designing your interactions to ensure that even marginalized members of the relevant community can be included.

community-guide-environmental-justice-and-nepa-methods.

44 *Engaging Communities For Health Equity and Environmental Justice: A Guide for Public Agencies,* California Department of Public Health, p. 2 (2021). https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHIB/CDPH Document Library/Guide-Engaging_Community_for_Health_Equity_and_EJ_ADA.pdf.

45 Malone, Elizabeth; James J. Dooley; Judith A. Bradbury. "Moving from misinformation derived from public attitude surveys on carbon dioxide capture and storage towards realistic stakeholder involvement," *International Journal of Greenhouse Gas Control*, 4, 419–425 (2010). http://dx.doi.org/10.1016/j.ijggc.2009.09.004.

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- When planning the location and timing of an interaction, ensure that these occur in times and places that allow community members to easily participate. If many members of the community lack reliable internet service, an online forum or meeting may not be the best strategy. Similarly, consider work and school schedules and cultural holidays or seasons when setting times for interactions.
- Choose sites for information and discussion that are seen as welcoming to the community. Preferably consult with community members on suitable locations that can be both effective and seen as neutral or safe spaces.
- The way information is communicated is also critical to accessibility. In communities where residents speak languages other than English, ensure that translation or interpretation services are available for all communications with residents. Levels of literacy in first languages other than English may also determine whether translation or communication services would be more appropriate. Furthermore, English may not be appropriate as the dominant language depending on the type of interaction and the community involved.[51] If there are low levels of English proficiency, literacy, or numeracy in a community, ensure that written materials are understandable by that audience. This may mean stripping communication of some technical language, avoiding complicated grammatical structures, and ensuring that any images that are included are chosen carefully and will not be misinterpreted.[52]
- Plan for interactions with the community, whether in-person or online, that account for the accessibility needs of individuals with a range of disabilities.[53] This is a critical element of effective engagement that incorporates recognition justice.

- *Employing techniques to build respect or trust (even when parties are not in agreement at various points).* This includes developing a reputation for honesty and truthfulness in communicating facts and developments, transparency when taking actions or seeking approvals, follow-through on commitments, and willingness to find information/expertise in response to community concerns.[54] It is also important for the project developer to be transparent about how community perspectives will be considered in decision-making.[55] This approach avoids over-promising as well as perceptions of misleading, or of wasting a community's time in a meaningless exchange.[56]
- *Providing education, training, and opportunities for community members to develop expertise and understanding.* In most cases an EJ community will have had no previous exposure to CCS. As a result, they will need access to trustworthy sources of information that may not be tied solely or directly to the project proponent or even the permitting authority; these sources may not begin with a presumption of credibility or even good intentions.
- *Developing co-owned/developed safety plans, commitments on operation.* Wherever possible, seek buy-in by working together with residents on safety plans, communication plans, and commitments to the community that will be implemented during the life of the facility's operation. A community that has meaningful input into the aspects of an operation that will most directly interact with their lives will be more likely to be accepting of both the facility and the adjustments that may need to occur from time to time. Such an approach is far better than an imposed plan or strategy that simply reflects a company's goals.

As an example, EPA's 2008 Collaborative Problem-Solving Model is designed to help communities address potential areas of improvement in environmentally burdened communities.[57] If this model is employed, multi-stakeholder collaborations may include academia, non-governmental organizations, civic organizations, local governments, and other partners. Outside experts with experience in environmental justice can also provide historical context, as well as effective methods for identifying environmental justice communities; their engagement can lend legitimacy to a project's environmental justice efforts.

51 Ibid., pp. 51–53.
52 Ibid., pp. 54–58.
53 Ibid., pp. 59–61.

54 "Best Practices for Meaningful Engagement," Groundwork USA (2018). https://groundworkusa.org/wp-content/uploads/2018/03/GWUSA_Best-Practices-for-Meaningful-Community-Engagement-Tip-Sheet.pdf.
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57 "EPA's Environmental Justice Collaborative Problem-Solving Model," United States Environmental Protection Agency (June 2008). https://www.epa.gov/sites/production/files/2016-06/documents/cps-manual-12-27-06.pdf.

Why is meaningful engagement important?

First, EJ communities are often accustomed to being affected by actions without much, if any, consultation, or engagement. This history can engender negative expectations and can contribute to poor outcomes even if a new project intends to be more communicative and interactive than those of the past.

Second, CCS technologies present unknowns to communities of all kinds. This creates opportunities for resistance or suspicion based on lack of information, or even on misinformation. Meaningful engagement by project developers is critical to create real understanding and a factual basis for discussion.

Third, it is not safe to assume what a community's interests or concerns are. Not every community is like every other, and it is important to first listen, to understand, and to learn. The history and experiences of a community may be quite different than initially thought, or raise unexpected, but perhaps quite resolvable, issues.

Fourth, community members may have expertise that is invaluable to a project. For example, knowing information or resources relating to siting or cultural issues and having the ability to identify respected and trusted community advisors and leaders who can assist may help create inroads to the broader community or facilitate real, workable mitigation strategies. Community members may be able to identify alternatives, solutions, or potential benefits that would not otherwise be identified (or accepted even if identified) by another.

LEADING PRACTICES

A review of environmental justice practices suggests five key options that can enable project developers to advance CCS deployments while respecting and advancing environmental justice goals.

1. *During the site selection process, determine whether the vicinity includes one or more EJ communities, using a screening tool and other information*. Project teams can "ground-truth" the information using a no-threshold approach initially to ensure that small or dispersed minority communities are not overlooked during the siting process, and so that concerns do not come as a surprise later in the process.
2. *Evaluate project approaches and opportunities for meaningful engagement, mitigation, and benefits with respect to all four of the environmental justice dimensions to determine what impacts may be perceived and how each may be addressed.* Procedural and distributional justice are likely to be the most familiar to employees and company staff, but attention to restorative justice and recognition justice as guide points can aid in identifying the best solutions. An environmental justice policy that incorporates the four dimensions can ensure clarity on key guidelines to follow from planning to execution of a project.
3. *Undertake meaningful engagement using a stepwise approach*. The steps to meaningfully engage local communities will heavily depend on the community involved in the process, and what means of engagement they find "meaningful" to their needs. What worked with one community might not be as effective with other communities.
4. *Design mitigation approaches collaboratively to address community concerns*. Solutions will be more acceptable and durable if community members have a stake in their development. Whether or not agreements are achieved, a commitment to recognition justice is likely to result in improving trust and building strong relationships.
5. *Identify and implement community benefits*. A community's perception of benefits will be framed by its experiences, especially if legacy and/or ongoing industrial facilities have disproportionately impacted the community. Effective delivery of benefits goes beyond traditional siting techniques, contributions, and community relations. It includes recognition of past environmental injustices, and ways to link new activities as well as direct activities associated with the project to the creation of community value. For CCS, this may mean additional pollution control or minimization.

Conclusion

Developing and deploying carbon capture and storage (CCS) at scale will require technological advancements and a buildout of retrofits and infrastructure. As with any development, there may be environmental justice concerns to address. Moreover, knowledge about CCS and its risks and benefits varies across populations and communities, and education will likely be necessary.

Integrating environmental justice considerations into CCS projects entails acting proactively to ensure that environmental justice communities can meaningfully engage in the process of project planning, development, and operation. This includes developing implementable risk-mitigation strategies and community benefits directly related to the proposed project and predicated on community needs.

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