

MEETING THE DUAL CHALLENGE

A Roadmap to At-Scale Deployment of
CARBON CAPTURE, USE, AND STORAGE

CHAPTER FOUR – BUILDING STAKEHOLDER CONFIDENCE



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Chapter Four

BUILDING STAKEHOLDER CONFIDENCE

I. CHAPTER SUMMARY

Wide-scale deployment of carbon capture, use, and storage (CCUS), including transport, as described throughout this report, will remain limited without public commitment and support.

At present, awareness of CCUS among the general public is low, primarily because a limited cross section of stakeholders has direct interaction with CCUS projects. As a result, the role that CCUS can play in effectively addressing key issues, such as climate change, energy security, and economic growth, is not well understood by the public. Additionally, knowledge and opinions about CCUS vary widely among those who do have a working knowledge of CCUS. This working knowledge is often directly associated with coal and, to a lesser degree, oil and natural gas. Gaining public confidence in, and support for, CCUS will require significantly improving its understanding of CCUS and multiple demonstration projects to illustrate that CCUS is safe and its operations are environmentally sound.

CCUS project-specific stakeholder engagement is well established in the United States, in part because of the U.S. Department of Energy's (DOE) Regional Carbon Sequestration Partnerships (RCSP), which has refined successful project-based public outreach and consultation programs. However, building widespread commitment and support through individual CCUS projects continues to be challenging. Although CCUS engagement on its own cannot guarantee success, when it is done well, it can be a significant enabler. In contrast, poor CCUS engagement

can, and has, prevented CCUS projects from moving forward.

The level of action needed to enable wide-scale deployment of CCUS is substantial and requires the support of a broad range of stakeholders, including policymakers, nongovernmental organizations (NGOs), and various industry groups. Federal, state, and local policymakers will need to understand the leading role CCUS can play to cost-effectively address carbon dioxide (CO₂) emissions in both the near and long term. Coalitions, independent organizations, and NGOs will need to work closely with industry, policymakers, labor organizations, and NGOs to educate and inform the public and support policies that will enable wide-scale deployment of CCUS.

It is also critical to clearly communicate the concept of CCUS and signify its objective by using terminology that is more accessible to the public. For example, replacing use of the acronym "CCUS" with "carbon capture" or "carbon management" would go a long way to advancing public understanding and discourse. The amount of technical details provided to explain a more easily identifiable concept can then be tailored for each type of stakeholder while ensuring the overall objective is explained and understood by all stakeholders.

II. INTRODUCTION

Stakeholders are those individuals and entities who perceive that they have a stake, or direct interest, in a project or program.¹ The CCUS

¹ Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Boston: Pitman.

stakeholder landscape is complex and engagement occurs in three primary spheres: project, policy, and public (Figure 4-1). Collectively, these are known as the “spheres of engagement.” For example, CCUS stakeholders include, but are not limited to, residents of a community, landowners directly impacted by projects, local and regional officials, regulators, civic groups (such as chambers of commerce), politicians, media, and other opinion leaders. For broader national and international policy audiences, stakeholders may include NGOs, regulatory agencies, such as the U.S. Environmental Protection Agency, state agencies, federal agencies, such as DOE and the U.S. Department of the Interior, industry, financial organizations, and elected officials. Environmental action organizations are stakeholders with interests that intersect all three of the primary spheres.

As shown in Figure 4-1, stakeholder engagement happens simultaneously within each sphere and overlaps between the three spheres of engagement. U.S. energy and environmental objectives are at the epicenter of the overlapping spheres. The primary outcomes shared between the spheres, where they overlap with one another, are project safety, effective policy, and public commitment. Gaining stakeholder confidence and support requires engagement in all three spheres of engagement. Successful engagement enables the nation to voice its energy and environmental concerns while providing an opportunity to build trust with stakeholders.

Engagement processes vary between the stakeholder groups, and each has specific needs. Engagement can also vary depending on stakeholders’ geographic proximity to projects with national, regional, and site-specific boundaries. When engaging stakeholders, it is important to understand their level of understanding and ability to influence projects or policies, either positively through support or negatively through opposition. Engagement with each group is the foundation for creating a broad and diverse stakeholder base. For example, public engagement programs need to understand and characterize stakeholder perceptions. Identifying potential common ground and opposition points is key to building trust and productive stakeholder relationships.

Trust requires that stakeholders are properly engaged and cultivated over time, creating relationships that can facilitate wide-scale deployment of CCUS. Open and positive engagement in the project sphere has proven to be critical in addressing the deeply held concerns of local stakeholders and has created an atmosphere of trust in which project developers can demonstrate that CCUS is safe and effective. Similarly, engagement is needed in the policy sphere to ensure local, state and national groups, lawmakers, industry, and other policymakers who define or influence the local or national energy agenda consider CCUS to be a safe and effective means to meet clean energy and environmental objectives. Once engagement in the project and policy sphere is well established and objectives and momentum have aligned, the process of engaging the public becomes more effective and widespread. However, even with a foundation of trust, it may take years to cultivate supportive relationships.

III. PUBLIC PERCEPTION AND CCUS

Public attitudes concerning the safe generation and use of energy are inextricably linked to environment, climate change, and renewable energy technologies. Those who are aware of CCUS often associate the technology with fossil fuels such as coal and, to a lesser degree, oil and natural gas. CCUS is a relatively unknown or misunderstood technology, and its positive role in addressing climate change, energy security issues, and economic growth is not fully understood.^{2,3}

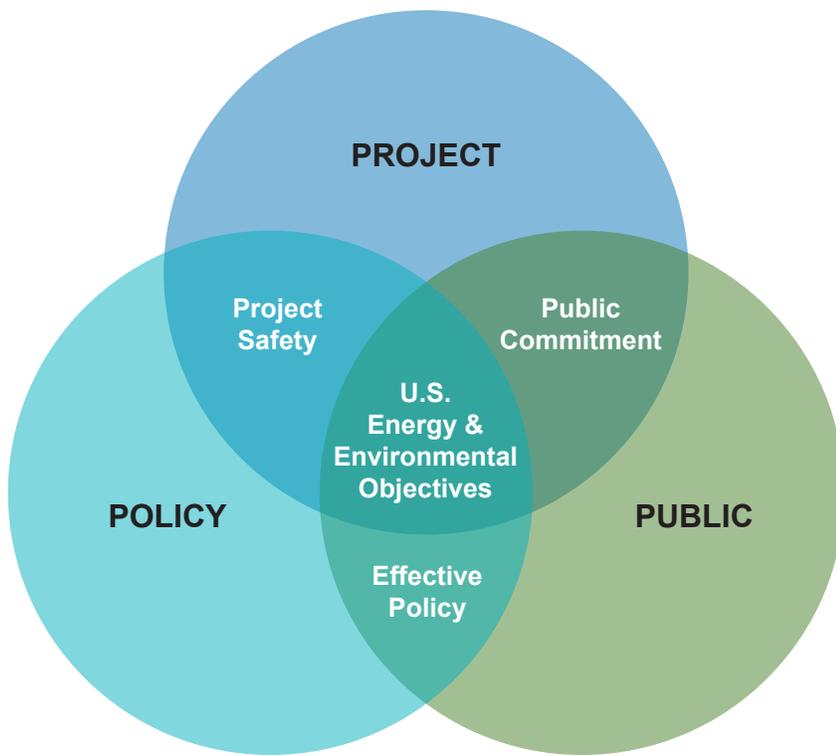
The connection between CCUS and industrial emissions has recently begun to be recognized,

2 Curry, T. E. (2004). “Public awareness of carbon capture and storage: A survey of attitudes toward climate change mitigation,” Massachusetts Institute of Technology.

Reiner, D., Curry, T., de Figueiredo, M., Herzog, H., Ansolabehere, S., Itaoka, K., Akai, M., Johnsson, F., and Odenberger, M. (2006). “An international comparison of public attitudes toward carbon capture and storage technologies,” Eighth International Conference on Greenhouse Gas Control Technologies, June 19-22, Trondheim, Norway.

Ashworth, P., Sun, Y., Ferguson, M., Witt, K., and She, S. (2019). “Comparing how the public perceive CCS across Australia and China,” *International Journal of Greenhouse Gas Control*, 86, 125-133.

3 Carpenter, S. (2017). “Transdisciplinarity within the North American climate change mitigation research community, specifically the carbon dioxide capture, transportation, utilization and storage community,” California Institute of Integral Studies.



Project Stakeholder Engagement

1. Conduct projects to demonstrate safety and address gaps in knowledge or experience.
2. Engage local stakeholders, regulators, and project developers.
3. Provide proof of concept.

Policy Stakeholder Engagement

1. Create effective legal and regulatory mechanisms and policy to support widespread deployment of CCUS.
2. Engage lawmakers, coalitions, policymakers, and industry.
3. Set policy to incentivize CCUS actions and development.
4. Identify common ground and potential opposition points.

Public Stakeholder Engagement

1. Create public engagement programs and opportunities.
2. Engage the public to build trust in carbon management.
3. Increase understanding and support.
4. Connect with the “big picture”—economy, climate, creation of jobs.

Source: Greenberg, S., information from stakeholder focus groups conducted for the NPC study, unpublished, 2019.

Figure 4-1. CCUS Spheres of Stakeholder Engagement

especially in the area of bioenergy carbon capture and storage. When considering cleaner forms of energy, renewables such as wind and solar are currently preferred by the public, despite their limited potential for meeting current and future energy demands.⁴ Public opinion about coal or natural gas power generation with CCUS lags far behind nearly all renewable energy sources. CCUS awareness also registers lower in the public mind than do natural gas and nuclear options as a means of achieving low-carbon energy generation.⁵ CCUS does not currently have the positive public profile needed to garner consideration among these options, which could impact acceptance of wide-scale CCUS deployment.⁶

4 Bonham, S., Chrysostomidis, I., Crombie, M., Burt, D., van Greco, C., and Lee, A. (2014). “Local Community Benefit Sharing Mechanisms for CCS Projects,” *Energy Procedia*, Vol. 63, pp. 8177-8184, <http://www.sciencedirect.com/science/article/pii/S1876610216300054>.

5 Greenberg, S., information from stakeholder focus groups conducted for the NPC study, unpublished, 2019.

6 Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., and Rosenthal, S. (April 2019). *Climate change in the American mind*. Yale University and George Mason University, New Haven, CT.

Despite successful project deployment and significant advances that demonstrate the ongoing safety of the storage component of CCUS, broad fears persist in the consciousness of the American public. A relatively small number of individuals and groups have had direct interaction with CCUS, usually through projects, policy development, or the local media. One barrier for public support of CCUS is an ongoing perception of the risk of catastrophic failure of the storage process.⁷

Proponents of the technology often argue that CCUS is an important integration of advanced technologies for addressing greenhouse gas emissions in a material and cost-effective manner. CCUS supporters cite these technologies as (1) a necessary component of climate models to reach 1.5°C greenhouse gas reduction targets, (2) having the greatest potential to safely store large volumes of CO₂, (3) serving as a bridge to cleaner energy technologies, (4) a means to

7 Greenberg, S., information from stakeholder focus groups conducted for the NPC study, unpublished, 2019.

commoditize CO₂ through both enhanced oil recovery (EOR) and non-EOR activities, (5) the only technology available for reducing emissions in the industrial sector, and (6) a component of the all-of-the-above energy portfolio.

Those who oppose CCUS cite (1) its cost, (2) the lack of a successful long-term track record, (3) its role in extending the use of fossil fuels, and (4) the investment tradeoff that prevents more deployment of renewable energy. CCUS opponents often argue that the window for widespread CCUS deployment has passed, and the focus should be on renewables and other clean energy options. Controversy may continue even when CCUS is well understood because benefits are accrued to the global community, but the impacts affect a local community.

In a 2019 study by the Global CCS Institute, policy influencers were surveyed to better understand their perceptions about CCS.⁸ The study surveyed 100 federal policy influencers (50 public and 50 private). Only about half of those polled recognized the term CCS. Among those who knew what CCS was, the majority said they believe it is safe but have specific concerns about seismic activity or leakage. They also expressed support of government efforts to deploy CCS. And, while CCS is perceived by policy influencers as prolonging the use of fossil fuels, they recognize that it has environmental and energy benefits. The policy influencers believe carbon utilization increases support for public investment in CCS and that direct air capture leads to greater support for public investment. There was overwhelming agreement that the United States should pursue lower-carbon technologies.⁹

Listening sessions and roundtable meetings were also conducted for this study to gain insight into a cross section of views within the environmental NGOs, oil and natural gas industry, and the financial sector. The environmental NGOs that participated see CCUS as essential to meeting near-zero emissions goals by 2050. They

expressed concerns about integrating CCUS into the broader infrastructure, passing on costs to consumers, and impacts on wildlife. Perceived risks associated with storage include leakage, accounting for stored CO₂, accurate reporting of data, and the efficacy of monitoring technologies. Industrial CCUS is seen as a critical component and as important as decarbonizing the power sector. The environmental NGOs also see a need for transparency and engagement that helps envision the infrastructure and timelines associated with CCUS. These groups want to continue to be engaged in listening and learning, staying current on issues and the messages around CCUS. One participant summarized future activities by saying there is a “need to advance the conversation—we are narrative creatures and respond as such.”

Financial stakeholders consider enabling factors such as international markets, debt financing, certainty in the technology, the presence of a clear legal framework, and economics. These stakeholders see the state of public understanding as a critical factor. Banks are interested in exploring CCUS and begin investing but need an integrated approach to reduce risk, noting that they face a steep learning curve. Key topics of interest to these groups are information about technology and liability, a broader conversation to address social issues, and balancing pressure by investors regarding funding fossil fuel companies.

The study also engaged a group of oil and natural gas companies to discuss perceptions of issues and challenges associated with the deployment of CCUS. These companies see access to capital and resources and capital allocation as issues related to developing CCUS. Large companies have resources and experience, while smaller companies may be flexible and act more quickly when establishing CCUS projects. Long-cycle projects are increasingly difficult to support. Pore-space ownership, long-term liability, durability of financial instruments, and time to permit were all cited as areas of risk and uncertainty. Oil and natural gas companies also expressed concern about reasonable rates of return for shareholders, durable funding mechanisms, stable legal and regulatory frameworks, and fiduciary responsibility. They are seeing a change in shareholder expectations that now include environmental, social, and

⁸ CCS is used here to reflect study results. Utilization was considered in the study, but not reflected in the chosen acronym.

⁹ Global CCS Institute. (2019). *US Policy Influencer Study 2019*, <https://www.globalccsinstitute.com/resources/publications-reports-research/us-policy-influencer-study-2019/>.

governance and governmental actions. They also see a need for clear and basic communication that is consistent, delivered at the appropriate level, and contains facts and examples while accounting for emotions.

Additional listening and discussion sessions with multiple stakeholder groups will be important to expand the understanding of stakeholder perspectives and broaden the spheres of engagement. Key factors shaping stakeholder perceptions on CCUS include the following:

Historical views on issues of environmental protection and climate change. Many stakeholders do not perceive CCUS as a viable climate change technology, or they care more about other environmental issues, such as pollution control. In some cases, concern about climate change is so strong that CCUS is perceived as a technology that cannot help in a meaningful time frame because it prolongs the use of fossil fuels and delays the deployment of renewable energy generation.¹⁰ Conversely, other stakeholders are unconcerned with climate change and believe CCUS is not worth the investment.

Personal impact and competing resource utilization. Stakeholders who have some understanding of CCUS raise concerns about the potential personal impacts of CCUS projects. Common views include “not in my backyard” (NIMBY) or “not under my backyard” (NUMBY) because a significant number of citizens do not want any type of energy infrastructure—wind, solar, CCUS, power plants, or industrial facilities—located nearby. Controversy exists even when storage sites are identified that meet NIMBY or NUMBY expectations. For example, saline storage has the potential to generate demand for compensation for use of pore space and the land surface itself. In other cases, there are concerns about the risk of adverse impacts on the use of pore space as a shared resource. Concern has also been expressed about storage hubs and large storage projects that receive CO₂ from multiple sources, because public perception is that the site is a dumping ground. Additional economic concerns exist that natural gas and CO₂ could potentially be mixed in

the subsurface if preexisting natural gas storage sites and the large-scale saline storage footprint share pore space.

Political leadership. Historically, CCUS has received bipartisan support because it has both environmental and economic benefits. Thus, government and industry support for CCUS can and should play a major role in increasing awareness and acceptance of CCUS projects. Leadership can vary within the U.S. political system, especially in regard to climate change, which can drive shifts in public attitudes. Climate change and the role of CCUS as a mitigation or solution technology are increasingly part of the political dialogue.¹¹ Legislative efforts continue to emerge that reflect current CCUS policy and potentially drive public opinion about CCUS. These types of efforts should be studied to honestly and responsibly improve public support for CCUS. Political leadership and the policy sphere can find common ground by creating a balanced energy portfolio that includes CCUS as part of an all-of-the-above solution in combination with renewables.

Trust in government institutions and corporations. Local experience with regulators, environmental management, and project developers plays a key role in building trust and shaping public attitudes. One example of a positive public perception experience is the public/private partnership of the Illinois Industrial Sources CCS project. ADM, the main employer in Decatur, Illinois, had community trust, worked with trusted partners such as the Illinois State Geological Survey and Richland Community College, and worked closely with DOE to actively engage stakeholders in their CCUS project.¹² Conversely,

11 Allen, M. (2019). “1 big thing: The climate election,” *Axios AM*, https://www.axios.com/newsletters/axios-am-bef979e1-5561-478a-8bfd-3e33eb8dceda.html?utm_source=newsletter.

American Geosciences Institute, “Hiring Trends of Recent Graduates, 2013-2017,” <https://www.americangeosciences.org/workforce/currents/hiring-trends-recent-graduates-2013-2017>.

Natter, A., “Republicans Who Couldn’t Beat Climate Debate Now Seek to Join It,” March 5, 2019, <https://www.bloomberg.com/news/articles/2019-03-05/republicans-who-couldn-t-beat-climate-debate-now-seek-to-join-it>.

12 Greenberg, S., Whittaker, S., and McDonald, S. (2018). “On the path to commercial CCUS: Scaling from field demonstration to regional hub,” 14th Greenhouse Gas Control Technologies Conference, Melbourne, October 21-26, 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3365965.

10 Carpenter, 2017.

the Barendrecht project in the Netherlands is an example of a negative public perception experience that resulted from the local government's lack of trust for a corporation that led to strong local public opposition.¹³ When building trust, public and private organizational integrity and competence remain paramount.

Socioeconomic considerations. The background conditions, needs, and resources of impacted communities play a significant role in a project's success. CCUS projects can potentially introduce jobs, training, and other community benefits, as well as draw on local resources such as community colleges and development efforts. Being able to clearly describe all the potential benefits along with a realistic assessment of risk that a CCUS project brings to a community can influence the level of support received. Understanding local environmental concerns is also critical to addressing the questions associated with planned CCUS activities. For example, communities with traditional water quality issues need to see reliable evidence that a CCUS project will not impact local water quality or access.

Environmental justice. Environmental justice is ensuring that all people have access to fair treatment and the opportunity for involvement regardless of race, ethnicity, national origin, or income around the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice is best achieved when there are equal degrees of protection from environmental and health hazards, and there is equal access to the environmental policy and decision-making process.¹⁴

Familiarity with the fossil fuel or energy industries. In geographic regions where the production of fossil fuels or hydrocarbon energy production exists, local stakeholders tend to have

a deeper understanding of how CCUS technologies can lower carbon emissions.¹⁵ In these areas, it is important to understand whether the public perceives the fossil fuel and energy industries as having a critical role in the local economy and a positive impact on the environment, or perceives them as a threat to the community and its environment.

IV. DEFINING STAKEHOLDERS

A. Project Stakeholders and Engagement

Globally, there are examples of both successful and failed CCUS projects. The basis for success and failure varies and sometimes may be attributed to poor stakeholder engagement. Carbon storage projects can fail or falter when public stakeholders perceive that project and/or policy stakeholders (proponents) are withholding important information about the project or changing the parameters of a project without input from those directly affected.¹⁶ Several CCUS projects have shown that responsible stakeholder engagement leads to successful implementation of those CCUS projects, particularly when there is alignment between government and project developers, social benefit, and communication mixed with a good measure of flexibility.¹⁷ Successful public engagement does not guarantee successful projects, but projects rarely proceed without first creating an opportunity for input from local citizens. To be transparent and open to input and influence, engagement processes must

13 Ashworth, P., Bradbury, J., Wade, S., Ynke Feenstra, C.F.J., Greenberg, S., Hund, G., and Mikunda, T. (2012). "What's in store: Lessons from implementing CCS," *International Journal of Greenhouse Gas Control* 9, 402-409.

Brunsting, S., de Best-Waldhober, M., Feenstra, C. F. J., and Mikunda, T. (2011). "Stakeholder participation and onshore CCS: lessons from the Dutch CCS case Barendrecht," *Energy Procedia* 4, 6376-6383.

14 Environmental Protection Agency. 2019. Environmental Justice. <https://www.epa.gov/environmentaljustice>.

15 Sacuta N. (2012). "Community Outreach," in Hitchon, B. (ed). *Best Practices for Validating CO2 Geological Storage: Observations and Guidance from the IEAGHG Weyburn-Midale CO2 Monitoring and Storage Project*. Sherwood Park AB: Geoscience Publishing, 321-329.

Sacuta, N., Daly, D., Botnen, B., and Worth, K. (2017). "Communicating about the geological storage of carbon dioxide – comparing public outreach for CO2EOR and saline storage projects," *Energy Procedia* 114, 7245-7259.

16 U.S. Department of Energy, National Energy Technology Laboratory. (DOE/NETL, 2017). *Best Practices: Public Outreach and Education for Geologic Storage Projects*, 2017 revised edition. DOE/NETL-2017/1845. https://www.netl.doe.gov/sites/default/files/2018-10/BPM_PublicOutreach.pdf.

Hund, G. and Greenberg, S. (2010). *FutureGen Case Study*. Global CCS Institute and CSIRO.

Forbes, S., Almendra, F., and Ziegler, M. (2010). *CCS and Community Engagement*. World Resources Institute, Washington, DC.

17 Ashworth et al., 2012.

be understood by all stakeholders. For example, the failed Barendrecht project in the Netherlands demonstrated that local stakeholders believed decisions about the project, particularly the location of storage, had been made without consultation and that engagement was conducted as an afterthought to inform residents of previously determined details.¹⁸

The United States and Canada are both leaders in successful stakeholder engagement for projects, including the Illinois Basin–Decatur Project, Illinois Industrial Sources CCS, Wallula, Bell Creek, FutureGen, FutureGen 2.0, Quest, Boundary Dam, and Petra Nova. Lessons learned from these and other projects provide valuable insights for addressing local stakeholder concerns and building trust. This success is, at least in part, because of the development of DOE’s seven RCSPs in the early 2000s. The RCSP projects resulted in not only geologic lessons learned, but also lessons from the public outreach and consultation programs. As a result of these lessons learned, processes and strategies were further refined, contributing to the development of best practices publications that included DOE’s *Best Practices for Public Outreach and Education for Carbon Storage Projects*.¹⁹

The RCSPs established a collaborative environment that drew together industry, government, NGOs, academia, and project operators. The regional approach stitched together key stakeholders that then began a national discussion while remaining rooted in the geology and economics of specific regions. This programmatic approach to stakeholder engagement shows a successful example of project-based engagement supporting and providing evidence-based information for policy and regulatory developments, as well as supporting public education. The Plains CO₂ Partnership is a good example of working with local public television to create a series of informative videos on CCUS that were widely viewed. The Southeast Regional Partnership Carbon Sequestration partnership, the Midwest Regional Carbon Sequestration Partnership, and the Midwest Geological Sequestration Con-

sortium created effective models of stakeholder engagement and school curricula that were shared throughout their regions. By way of example, each of the partnerships was able to leverage project experiences for engagement opportunities at local, state, national, and international levels, which proved to be a powerful mechanism to explain and demonstrate the how and why of CCUS to a broad audience.

The resulting group of stakeholder engagements created by the DOE partnerships enabled the project proponents and its trained professionals to expand their international network of colleagues involved in CCS/CCUS projects and research in Australia, North America, Europe, and Asia. As a result, these DOE partnerships have refined CCS/CCUS stakeholder engagement practices and processes. International knowledge-sharing and collaboration has continued to accelerate the deployment of CCUS globally and served to build confidence among government, project stakeholders, and the general public. A wealth of knowledge currently exists among this network of engagement and subject matter experts from early CCUS demonstration projects; leveraging the knowledge and best practices from these experts can successfully guide new CCUS projects in understanding what to do and what not to do when engaging stakeholders.

CCUS has learned many technological lessons from the oil and natural gas industry and may also gain insight from successful stakeholder engagements currently underway in this sector. Although the underground injection control Class II permitting process for oil and natural gas wells does not require a significant amount of public engagement, the industry has begun engaging communities through project-specific processes because environmental concerns have escalated. Infrastructure (wells, refineries, pipelines) or site development and monitoring (seismic surveys, ground water sampling) may require repeat public interaction. Local engagement by industry is often driven by infrastructure, production, and maintenance, as well as the fact that many employees live in the community, or the industry may be a major force in the local economy.

¹⁸ Ashworth et al., 2012; Forbes et al., 2010.

¹⁹ DOE/NETL, 2017.

For example, as oil and natural gas companies expand CO₂ EOR projects, engagement is typically focused on regulators and owners of the subsurface pore space and mineral rights. As policies to support CO₂ capture have been promoted, many in the oil and natural gas industry have engaged policymakers to share information about the benefits of ancillary CO₂ storage from CO₂ EOR. In another example, stakeholders continue to express concerns over the impacts of hydraulic fracturing and the potential for induced seismicity as a function of shale gas development. Activities related to the subsurface are often not well understood by public and policy stakeholders, which can lead to general concern and reluctance. These interactions have led to an increase in engagement in the policy sphere and may lead to more locally driven engagement as well as change in permitting processes or societal expectations.²⁰ As these types of projects continue to develop, it is important to understand the extent to which they may be viewed differently than conventional oil and natural gas operations and in conjunction with saline storage.

Another source of project-level experience is in the power sector, where significant large and long-lived infrastructure decisions are made that have significant local impact. These kinds of projects tend to draw a full range of active stakeholders and spur healthy debate. Power companies also consider their long-term role in providing power and jobs in the communities they serve. Historically, power companies have looked for multiple ways to build community relationships and to be ready to respond to accidents, investments, and other major activities. Power companies involved in CCUS projects, such as those conducted by Southern Company at the Barry and Kemper plants, have often front-loaded public engagement to build awareness and support and to assess project viability.

Beyond the direct value or impact of a project's success, project experiences also provide policymakers with evidence and information about the specific enhancements or improvements needed to enable widespread deployment of CCUS. Projects provide the public with opportunities to see

and experience CCUS for themselves, understand how it works, and recognize that it can safely and effectively capture and store CO₂.

Given the limited number of projects in the United States today, project experience alone is not enough to bridge the awareness gap associated with CCUS. For most of the public, CCUS remains a relatively unknown concept with very little connecting it to energy production or the environment. The more projects that can be successfully implemented, the greater the opportunity to more broadly demonstrate to the public the benefits of CCUS.

B. Lessons Learned from Early CCUS Projects

Successful CCUS demonstration projects have shown that providing a reliable and trusted local point of contact (face of the project) is just as important as the message being communicated. For example, the oil and natural gas or power industries often may have a good rapport with stakeholders within their local regions as the result of being an employer of many stakeholders and contributing to the local economy. In these areas, companies involved with CCUS projects should begin communication from within by educating employees about the project and by answering their questions and concerns. Knowledgeable employees can become project experts or informal spokespersons who are proud to share factual and relevant information when asked by friends and neighbors in the communities where they live and work.

Identifying groups and individuals within a local community who may be affected by the project's development, implementation, and operation is key for successful engagement, particularly in communities unfamiliar with subsurface activities.²¹ An effective engagement process must allow stakeholders to influence, respond to, and feel heard in the development of the project, regardless of their position. This

²⁰ DOE/NETL, 2017.

²¹ Forbes et al., 2010; DOE/NETL, 2017.

American Petroleum Institute. (2014). "Community Engagement Guidelines." ANSI/API Bulletin 100.3, https://www.api.org/~media/files/policy/exploration/100-3_e1.pdf.

type of interactive engagement process creates a meaningful platform that assures stakeholders their input is respected and can influence or impact the project. Recognizing that a community or location may never be willing to engage or accept a proposed project must be accepted as a potential outcome of the engagement process. Regardless of outcome, an engagement strategy should not be contingent on convincing a population of stakeholders about a predetermined outcome. Instead, engagement activities should be designed to establish trust, paths of communication, and, when reasonable and feasible, a willingness to adapt or change a project to accommodate stakeholder perspectives and concerns.

To achieve this, engagement for a CCUS project should begin as early as possible, definitely when site selection is underway, and should include a range of engagement mechanisms and tools such as one-on-one conversations with landowners, project presentations at community-led events, open houses for the wider community, social media information campaigns, and, where possible, organization of site tours of the relevant facilities for interested members of the local public, media, and government officials.²²

Engagement activities should be designed to provide consistent, continuous, and open collaboration and communication among internal project managers, risk managers, outreach team managers, and policy and public stakeholders. To mitigate potentially sharing mistakes or incorrect information with project or stakeholder communities, two-way respectful communication is essential—sharing project information, explaining what the information means, listening to community concerns and potential misconceptions, and answering questions using easy-to-understand terminology and imagery. Communication should also be conducted through as many channels as possible, because stakeholders vary where they get information and what information they trust.²³

22 DOE/NETL, 2017.

23 ter Mors, E., Weenig, M., Ellemers, N., and Daamen, D. (2010). "Effective communication about complex environmental issues: Perceived quality of information about carbon dioxide capture and storage (CCS) depends on stakeholder collaboration." *Journal of Environmental Psychology*, 30:4, 347-357.

C. Policy Stakeholders and Engagement

Stakeholders in this sphere include federal and state legislators, regulators, NGOs, and industry associations. Policy engagement relies on the same principles as projects, but with a broader scope, and draws on evidence of successful CCUS projects. Stakeholders in this sphere may consider a project in relation to its impact on policy rather than the specific local impacts of the project, but they may also be active in a community where a project is planned.

Engagement in the policy sphere generally focuses on specific legal, regulatory, or policy mechanisms that impact CCUS deployment. A group advocating for a new or changed policy will identify concerns among various stakeholders so they can be proactively addressed. Because this is a diverse group of decision-makers with varying levels of knowledge about energy, the environment, and CCUS technologies, engagement with this category includes stakeholders who need varying levels of information about how CCUS works, why it is important, and its potential economic and environmental benefits. Understanding the audience and preparing materials specifically crafted to provide the depth of information needed by this diverse group is an important factor at this stage. Engaging at the policy level may also require reaching out to the far wings of the political spectrum and illustrating how different factions, from those seeking aggressive climate change mitigation to those who support CCUS, can find common ground.

One example of an effective and still-evolving effort is the Carbon Capture Coalition, formerly the National EOR Initiative, which was formed after broad U.S. climate legislation failed. Convened by the Center for Climate and Energy Solutions and the Great Plains Institute, the Carbon Capture Coalition has brought together leaders from industry, the environmental community, labor organizations, and state governments, to build support for policies that enable greater CO₂ storage through EOR. The initial focus was to advocate for extending and expanding the existing Section 45Q tax incentive for carbon capture projects. Working together across a broad group of stakeholders, the Carbon

Capture Coalition and the Carbon Utilization Research Council helped drive the expansion of the 45Q tax credits to include utilization options beyond EOR, address minimum eligibility storage requirements to meet the needs of industry and demonstration projects, gain new understanding of the importance of saline storage to some environmental groups, and refine the message to reinforce the value of EOR for both increasing domestic energy independence and addressing the risk of climate change. In fact, CCUS may be experiencing a broader appeal because of its potential to create benefits across the political spectrum. A combination of largely Democratic support for addressing climate change, Republican support for the use of captured CO₂ in EOR, and bipartisan recognition of the potential for using CO₂ in the manufacture of everything from shoes to cement was key to passing the tax incentive.

California's Air Resource Board (ARB) provides yet another example of how existing engagement processes influence policy and regulation. The ARB was instrumental in developing recently adopted quantification methodologies (QMs) used for specifying how captured CO₂ can be eligible for credits within the state's low-carbon fuel standard. Prior to drafting regulations, the state held eight workshops to solicit input from stakeholders between February 2016 and May 2017. The workshops addressed a range of topics, including site selection, monitoring, well mechanical integrity, and accounting protocols. At the conclusion of these workshops and meetings, the ARB drafted proposals that were open to public comment. Throughout the process, the ARB reached out to diverse stakeholders in the state, including environmental justice groups, academics, and industry. The QMs were formally adopted in September 2018.

D. Public Stakeholders

Advancing CCUS deployment depends on public understanding of the role CCUS plays and confidence that technologies across the value chain are safe and reliable and effectively reduce CO₂ emissions at a rate that will inhibit climate change and benefit society. Not surprisingly, the most challenging area for project and policy stakeholders is engagement with the public sphere. Success with this group of stakeholders will require creating explanatory, approach-

able, and straightforward processes and materials that can resonate with a broad range of perspectives. It is important to distill concepts to facilitate communication, but not to oversimplify to the extent that mistrust results.²⁴ This type of engagement will influence overall stakeholder perceptions and needs to expand as deployment of CCUS progresses. It is important to recognize, however, that as CCUS is deployed more broadly, the engagement and education process will need to continue and will remain an explanatory challenge. Thus, having a comprehensive and clear energy and environmental policy, along with successful demonstrations of projects, is necessary to ensure the general population understands the role of CCUS as a carbon mitigation technology that is important for the U.S. environment, economy, and energy security.

It is also important to encourage and empower the public to play a role in CCUS deployment, providing it with ample opportunities to ask questions and raise concerns, engage with elected officials and project developers to understand impacts and benefits, and to take part in discussions about energy, climate, and societal expectations.

One of the most important roles of stakeholder engagement is establishing the opportunity to bridge the entire CCUS value chain and create an interface between the three spheres of engagement—project, policy, and public—while continuing to refine and deliver the message that CCUS is safe and necessary.

The multitude of perspectives and opinions across stakeholders reinforces the importance of understanding popular attitudes in the stakeholder engagement process. Despite specific factors that may influence perception, experience has shown that a consistent set of questions is asked by all stakeholders regarding CCUS,²⁵ including:

- What is CCUS? What is carbon capture?
- How does it work?
- Is it safe?

²⁴ Forbes et al., 2010.

²⁵ Greenberg, S., Gauvreau, L., Hnottavange-Telleen, K., Finley, R., and Marsteller, S. (2011). "Meeting CCS communication challenges head-on: Integrating communications, planning, risk assessment, and project management." *Energy Procedia* 4, 6188-6195.

- Will it impact my property value?
- Who pays for it?
- Who is responsible for CO₂ once it is stored?
- Will it cause earthquakes?
- What happens when you have an earthquake?
- Will it damage my groundwater/drinking water?
- Is it a ploy to continue to use fossil fuels at the expense of renewables?
- Is this process taking oxygen out of the atmosphere? Is it harmful?
- How many carbon capture plants are operating today?

It is critical that, at a minimum, any stakeholder engagement in any of these spheres addresses these questions and provides a basis for which all stakeholders can begin to understand the role of CCUS in substantially reducing the emissions associated with a broad range of industries.

V. DEPLOYING STRATEGIC STAKEHOLDER ENGAGEMENT

A robust stakeholder engagement process involving all stakeholders in the spheres of engagement considers the sociopolitical landscape, develops effective means of communication with critical stakeholders, aligns with local objectives and government policy, and is transparent and adaptive.²⁶ All engagement requires listening to stakeholder input to help shape the project parameters required to reconcile objectives and stakeholders' needs and concerns. Furthermore, the development of messages that will resonate with stakeholders is critical. Equally important is developing responses to address opposition.

The key to successful engagement is identifying and planning for the who, what, when, where, how, and why associated with the engagement goal. The strategy developed should consider the

²⁶ DOE/NETL, 2017; Forbes et al., 2010.

Ashworth, P., Bradbury, J., Feenstra, C.F.J., Greenberg, S., Hund, G., Mikunda, T., Wade, S., and Shaw, H. (2011). "Communication/Engagement Toolkit for CCS Projects." CSIRO EP105893, Australia.

Ashworth, P., Boughen, N., Mayhew, M., and Millar, F. (2010). "From research to action: Now we have to move on CCS communication." *International Journal of Greenhouse Gas Control*, 4:426-433.

timing of engagement strategies; the importance of gaining knowledge about the community; the identification and communication of the project's local benefits; an understanding of how, when, and what to communicate and engage; and how best to use appropriate sources of information.²⁷ Many resources and tools are available to inform the engagement process. Methods draw from social science assessments and include surveys, one-on-one interviews, media reviews, and other methods to identify and understand public opinion and important stakeholder groups.²⁸

A. Social Site Characterization

Experience indicates that stakeholder perceptions of CCUS projects tend to be more strongly influenced by socioeconomic factors than the technical details of any given project.²⁹ Efforts must be made to gain a preliminary understanding of the physical, environmental, and social characteristics of a project or policy. It is equally important to understand local and regional economic considerations.

Social site characterization is a process that draws its reference from the critical role of geological site characterization for CCUS projects. However, social site characterization suggests that in addition to assessing the technical and/or physical characteristics of a site, the social or human characteristics or impacts should be considered when selecting and designing projects.³⁰

²⁷ Ashworth et al., 2012.

²⁸ Wade, S., and Greenberg, S. (2011). "Social Site Characterization: From Concept to Application." Canberra: Commonwealth Scientific and Research Organisation.

Ashworth, P., Bradbury, J., Feenstra, C.F.J., Greenberg, S., Hund, G., Mikunda, T., Wade, S., and Shaw, H. (2011). "Communication/Engagement Toolkit for CCS Projects." CSIRO EP105893, Australia.

²⁹ Wade and Greenberg, 2011.

³⁰ Wade, S., and Greenberg, S. (2009). "Afraid to start because the outcome is uncertain? Social site characterization as a tool for informing public engagement efforts," *Energy Procedia* 1:1 (February 2009) 4641-4647.

Wade and Greenberg, 2011.

Ashworth, P., Dowd, A-M., Rodriguez, M., Jeanneret, T., Mabon, L., and Howell, R. (2013). "Synthesis of CCS social research: Reflections and current state of play in 2013." CSIRO EP134303, Australia.

Jammes, L., Vervier, P., and Lesueur, T. (2015). "Social site characterization and stakeholder engagement." Melbourne: Global CCS Institute.

Social site characterization and stakeholder identification are intertwined and employ “the common steps of stakeholder identification, mapping, and response.”³¹ Social site characterization includes an analysis of the project context and proposed location, identification and mapping of stakeholders (including identifying concerns, local factors such as economic, political, environmental, social, and project-related issues that could arise), and the development of a stakeholder engagement plan based on an analysis of project-related issues.³²

Social site characterization becomes even more important as widespread industrial deployment of CCUS occurs. As CCUS is increasingly put forward as an option in addressing emissions from industries that are not associated with energy production (i.e., cement and steel manufacturing), CCUS proponents making decisions about stakeholder engagement put projects at risk if they do not complete social site characterization work on communities in and around the siting of such projects, particularly in regions without an active oil and natural gas industry.

B. CCUS Communication Strategies

Although engagement at the project level has been successful in many instances, messaging around CCUS has historically been overly technical, decentralized, and inconsistent, enabling misconceptions to form about the technology. Some of the most persistent misconceptions about CCUS are: it does not work; the technology is too expensive and not deployable at commercial scale; it, or related activities such as storage, is not safe; it is not needed to meet climate goals; and it only enables continued use of fossil fuels.

Three key aspects will drive future communication strategies for CCUS: framing, messaging, and messengers.

CCUS stakeholder communication and education have traditionally focused on explaining the complex technologies in detail and providing spe-

cifics about subsurface activities, which are often challenging and misunderstood. More recently, simplifying the message has increased understanding and gained public support at the project level. Instead of using a technical approach that defines sources and storage sinks, value chains, and climate models, CCUS policies and deployment would benefit from a simplified nontechnical approach that describes how CCUS is a technology that can be applied to all energy-intensive industries and is therefore neutral to the carbon management process.

Successful acceptance of CCUS requires complete, strong, and consistent messages delivered by a variety of messengers who are well versed in CCUS technologies and the role these technologies can have in meeting U.S. energy and environment objectives. One advantage of CCUS is that it lends itself to flexible messaging and can encompass many benefits, ranging from climate management to energy security. This flexibility should be leveraged while striving for consistent messaging.

The engagement activities and materials used can have a significant effect on stakeholder understanding of CCUS. Communication materials that incorporate multiple views and are authored by diverse groups (industry, NGOs, government, and academia) are often trusted more than overly polished approaches that may even cause mistrust.³³ It is important to remember that NGOs and environmental activist organizations are an integral part of the spheres of engagement. They have a persuasive voice within the public and policy spheres. It is critical to have open dialogue with these groups to ensure that all sectors in the spheres of engagement are included in the communication process.

C. Consistent and Accessible Messaging

Accessible education and communication concepts need to be developed and distributed to increase understanding of CCUS. A broad range of advocates and climate scientists have supported a rebranding of CCUS focused on using an easier-to-understand name that matches

³¹ Wade and Greenberg, 2011.

³² Jammes et al., 2015.

³³ ter Mors et al., 2010.

efforts to demystify the technology. Creating a more easily recognizable name, such as carbon capture or carbon management, provides an opportunity to shift public perception of the technology from expensive and not ready to an existing technology and critical to addressing global climate goals.³⁴ The amount of technical details included when discussing the general concept can be adjusted to suit specific stakeholders while allowing for the overall concepts to be understood or explained.

Additionally, focused communications about technologies that enable carbon use beyond EOR, and terms like “carbon removal” can be a helpful entry point to discussing carbon capture across the political spectrum. Climate advocates are often more comfortable with carbon removal and the economic potential of carbon use beyond EOR, and these simpler but accurate terms can appeal to conservatives. Describing the economic benefits will often resonate with all parties.

ClearPath, an NGO that supports carbon capture within its larger mission to promote clean and reliable power, convened a small bipartisan focus group of congressional staffers in early 2017 and found that most had not moved beyond the negative associations with expensive projects that have failed. This congressional staff focus group produced a set of findings and recommendations that remain relevant and should be considered for implementation in future stakeholder communications.

The focus group found that acronyms do not work. Almost all the staffers referred to the technology as “carbon capture” in public outreach. As one staffer noted, “We’d use carbon capture with our bosses, but CCS amongst ourselves.” Some staff members noted that carbon capture technically only references one-third of the use case for the technology by omitting the utilization and storage/sequestration benefits, citing this as a challenge to the nomenclature used for the technology. But the same could be said for the common shortening of concentrated (or photovoltaic) solar power to simply solar power.

The most popular single message emerging from the 2017 focus group was that carbon capture is a technology that the United States will be able to sell around the world, helping our economy and trade balance and addressing growing coal use in developing nations and natural gas use more broadly. The opportunity for the United States to play a key role in addressing the global climate issue through development and exportation of technology is a message that resonated with staffers. Opinions about CCUS will continue to change as policy drivers are put in place. Therefore, continued listening sessions and research will be needed to understand changing perceptions among policymakers and other stakeholders.

Policy influencers from the 2019 Global CCS Institute study recommend framing CCS as an effective tool to address climate change and achieve the goal of carbon emission reduction, addressing concerns about costs, highlighting increased commercial interest and investment in carbon utilization and direct air capture, and addressing lingering concerns over safety.³⁵

In a similar approach, the Carbon XPRIZE, along with Carbon180, Circular Carbon Network, and CO₂ Value Europe conducted a survey to better understand “terminology, messaging, perceptions, challenges, and opportunities” around carbon utilization outside of EOR. Their report, *Communicating the Value of CO₂*, found that the most popular terms for the technology were “carbon capture and utilization” and “carbon tech.” The report also emphasized that respondents believed these technologies should be framed as complementary to, and not competitive with, renewables.

Although recent efforts like those described above have begun shifting stakeholder perceptions, there remains a clear need for more accessible CCUS terminology and for experts and advocates to be thoughtful about messaging. It is important to be mindful of the language used in stakeholder engagement to ensure messages are clear, understandable, and make sense for the target audience.

³⁴ Global CCS Institute, 2019.

³⁵ Global CCS Institute, 2019.

D. Skilled Messengers

Another challenge for stakeholder engagement is the alignment of messenger, message, and stakeholder needs. This is necessary when determining the engagement strategy needed for commercial deployment. Gaining support for CCUS requires the explanation of complex technical information to audiences with minimal understanding of key technology concepts.

In the project sphere, engagement programs need to identify credible sources of information from the stakeholders' point of view. Stakeholders often seek information from people and sources they trust, even if those sources are not experts on topics related to CCUS. The most credible sources of information for community engagement must be identified on a site-specific basis. Such individuals may be local sports heroes, business leaders, social networkers, or other messengers with the potential to connect with stakeholders. It will vary in each community. The assessment of credibility is based on stakeholders' perceptions of a person's motivations, knowledge, and relationship to the project and the community. In areas where potential negative perceptions are likely, it is important to find good communications partners and to focus on building local relationships in the community.³⁶

In the policy sphere, engagement programs should leverage industry, academia, coalitions, and advocacy groups with good communication skills to explain and build support for CCUS. Policymakers may not have the most comprehensive knowledge or understanding about CCUS, so involving a broad range of participants can help to educate policymakers and lead to better and more effective policy design. The oil and natural gas industry and other industries provide relevant examples of how successful outreach efforts with policymakers has led to greater understanding of and support for the benefits created for both the communities where they operate and for the nation as a whole.

A challenge for CCUS messengers will be the successful use of digital communications, such as social media, to engage stakeholders. These

types of communications play an increasingly important role in mobilizing public attitudes toward CCUS projects. Finding ways to effectively engage various stakeholder groups through a range of communications platforms will be key to reaching a broad and diverse group of stakeholders going forward.

VI. CONCLUSIONS

Building support for a comprehensive U.S. commitment to CCUS requires broad stakeholder engagement among and within the three spheres of engagement—project, policy, and public. The CCUS stakeholder engagement process would benefit from, and should support, clear and comprehensive policies to promote widespread deployment of CCUS that drive greater domestic energy security and address the risks of climate change by substantially lowering U.S. CO₂ emissions.

Engagement for CCUS deployment enables public discourse about the United States' existing energy infrastructure, the decarbonization of energy intensive industries, securing jobs, and ensuring national energy security and global competitiveness. Additionally, the United States can reinforce its position as a technology leader in CCUS by becoming an exporter of CCUS technological expertise. Conducting meaningful engagement, clarifying messaging, demonstrating societal benefits, and creating educational opportunities and social research are the keys to building trust and lasting stakeholder relationships.

A robust stakeholder engagement process considers the sociopolitical landscape, develops effective means of communication with critical stakeholders, aligns with local objectives and government policy, and is transparent and adaptive. All engagement requires listening to stakeholder input to help shape the project parameters that are required to reconcile objectives and stakeholders' needs and concerns. In addition, development of messages that resonate with stakeholders is critical and responses developed to address opposition are important. CCUS is a complex system that requires clearly defining the technology, costs and benefits, and risks in an easily understood format.

³⁶ Greenberg et al., 2011.

Consistent and high-quality CCUS stakeholder engagement is essential, but it is not the silver bullet to achieving deployment at scale. CCUS will continue to face opposition, and effective strategies need to be in place to engage, listen, and work across issues, lean into opposition, and create opportunities for finding common ground.

VII. RECOMMENDATIONS

A. Conduct Meaningful Engagement

- All members in the spheres of engagement should be engaged early in a series of national discussions on CCUS that includes federal and state government, industry, policy and environmental stakeholders, and the public to meet the dual challenge of providing energy while reducing environmental impacts. Discussion formats could include town hall meetings, policy briefings, focus groups, online interaction, and workshops.
- CCUS policy and projects require systems thinking across CO₂ emitters, transporters, and users, each often having different risk profiles, return expectations, and contracting strategies and structures. All stakeholder levels should better utilize and expand the stakeholder engagement process to:
 - Address legal and regulatory issues, such as IRS clarification of the Section 45Q tax credit, use of federal land, and long-term liability
 - Create and facilitate mechanisms, such as policy discussion events around this report, that encourage frank conversations about energy and emissions
 - Create an ongoing series of listening sessions and conduct research to understand changing perceptions among policymakers and other stakeholders
 - Continue demonstrating to the public that CCUS projects have environmental integrity and will sequester material amounts of CO₂ from the atmosphere
 - Engage with financial institutions on the technical details and risks associated with CCUS, better understand shareholder concerns, and advance a broader conversation to address social issues.
- Educate consumers on the merits of CCUS to enable consumer demand for low-carbon products.
- Industry and NGOs should create coalitions and utilize trade organizations to work together to educate and engage internal and external stakeholders.
- DOE should increase and sustain federal and state crossover engagement opportunities and linkages through the Regional Partnership Initiative, state working groups, and other similar organizations.
- Industry, RD&D coalitions, and DOE should continue to demonstrate leadership in international carbon capture and storage government, industry, and nongovernmental agency international forums, such as the IEA CCS Unit, IEA Greenhouse Gas R&D Programme (IEAGHG), Carbon Sequestration Leadership Forum, Oil and Gas Climate Initiative, and Clean Energy Ministerial.
- DOE should work with other agencies to formalize the interagency CCS work group to meet regularly, generate interagency reports, and provide materials suitable for stakeholder engagement that can facilitate integration of technical, economic, and societal aspects of CCUS.
- All stakeholder spheres should continue to require funded CCUS programs and projects to prioritize stakeholder engagement at the project level using best practices.

B. Clarify Messaging

- Multiple stakeholder groups should work together to simplify the language used to discuss CCUS and agree upon an easy-to-understand and recognizable moniker.
- A program for training communication champions and empowering stakeholders should be developed, including assessments to measure impact toward advanced deployment.
- The National Petroleum Council should create engagement opportunities using the NPC CCUS study as a platform, create talking points, and create summary materials that outline a clear set of recommendations of how to apply CCUS study findings to policy.

- Create events that share lessons learned and result in the continuation of deploying best practices for influencer and project-level stakeholder engagement efforts.

C. Demonstrate Societal Benefits

- Industry, academia, and DOE should support mechanisms for evaluating and demonstrating CCUS social benefits and impacts, including a set of common metrics for tabulating the benefits of CCUS projects.
- Congress should expand DOE's authorization and appropriations to fund research on social and economic drivers of CCUS through organizations such as the IEAGHG Social Research Network.
- DOE should commission a national economic development and jobs research study to bet-

ter understand the potential for CCUS-specific economic impacts jobs.

D. Fund Engagement Research and Education Opportunities

- DOE should provide dedicated funding for CCUS education and research on stakeholder engagement processes and impacts, and require integrated analyses, results sharing, and joint work products, as part of new CCUS projects and programs.
- DOE should collaborate with other agencies, such as the National Science Foundation and Department of Education, to consider new funding models for education and engagement that align with emerging technologies and support continued research, development, and demonstration.

