



I-WEST

Intermountain West Energy Sustainability & Transitions

WORKSHOP SUMMARY

CO₂ Capture from Regional Point Sources: 5-year Deployment Outlook

Virtual workshop held November 20, 2021

WORKSHOP FACILITATORS

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Summary of Workshop on Point-Source Capture

This workshop was the first technology-focused workshop for the I-WEST initiative (see section 1.1 for more information on I-WEST). Our initial regional, place-based outreach occurred over the summer and informed this workshop.

The workshop targeted the role of point-source capture in achieving carbon neutrality in the Intermountain West. Capture of CO₂ at large point sources emerged as a regionally relevant technology pathway based on the strong regional interest in CO₂ capture, utilization, and storage (CCUS), based on the role of CO₂ emitting point sources on the regional economy, based on the impacts already being felt in the region by closure of CO₂ emitting power plants, and based on the identification of a number of emerging projects in the region.

With more than 400 point sources in the Intermountain West region, totaling ~200 Mt/year of the total ~385 Mt/year of CO₂ emissions, point-source carbon capture is emerging an important technology pathway toward achieving carbon neutrality in the region. In previous stakeholder engagements, CO₂ capture at large point sources garnered strong interest based 1) strong regional interest in carbon capture, utilization, and storage (CCUS), 2) the role of CO₂ emitting point sources in the regional economy, 3) impacts already realized from the closure of CO₂ emitting power plants, and 4) numerous point-source capture projects emerging in the region.

While it may be possible that not all of the point sources in the region are amenable to CO₂ capture, many of them are already utilizing capture technology or are interested in pursuing carbon capture in the future. The workshop was planned to solicit information that would help the I-WEST team answer following key questions:

- How many of the point sources are likely targets for capture
- How many are likely to proceed as projects in the next five years
- What is the state of technology for sources in the region, and what R&D could facilitate a broader deployment of CO₂ capture in the region?
- What are the non-technological factors that could facilitate or impede deployment?
- Which stakeholders are actively engaged in assessing or pursuing projects in the region?

The four-hour workshop, which was held virtually due to COVID restrictions, was by invitation only. The I-WEST team identified stakeholders involved in existing or emerging carbon capture projects who would be able to provide insights for formulating the I-WEST roadmap relative to the questions above. The workshop included 28 stakeholders from 22 organizations active within the region (section 1.2).

The format of the workshop centered on two moderated roundtable discussions: one focused on technology-related factors, and one focused on non-technology-related factors (see agenda in section 1.3). The moderators for each session developed a set of questions to be used as prompts for the discussion (section 1.4), and these were circulated to the participants one week prior to the workshop. At the workshop, the moderators provided a short introduction to each session and then facilitated dialog.

Key takeaways from the workshop are summarized in Section 1.5.

1.0 Details on the Workshop

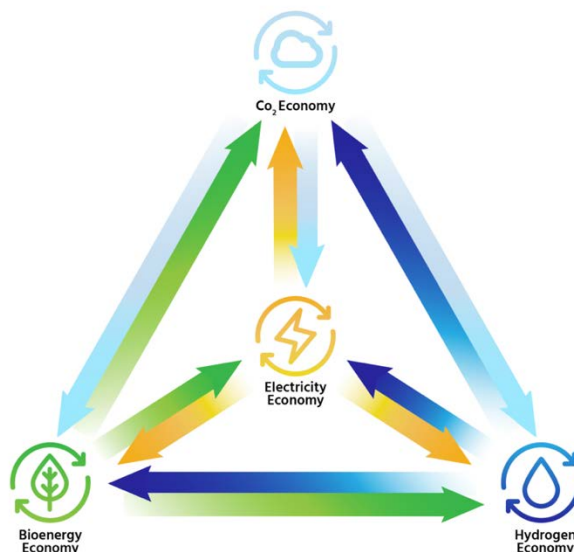
1.1 Overview of the I-WEST Initiative

The Intermountain West Energy Sustainability & Transitions (I-WEST) project is focused on delivering a technology roadmap to transition six states in the U.S. Intermountain West to a carbon neutral energy system. I-WEST encompasses Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming. The project is taking a place-based approach, which prioritizes the unique attributes of the region so that the resulting technology roadmap reflects pathways that are regionally relevant and can be put on an accelerated timeline to deployment.

As part of its Phase-1 assessment, the I-WEST team is holding technology-focused workshops to better understand technology readiness, infrastructure, policy, and societal readiness related to each of the technology pathways under consideration. These include the capture and use of carbon dioxide, the production and use of carbon neutral hydrogen, and the production and use of bioenergy and bioproducts.

The workshops target leaders of current and emerging projects in the region and present opportunities for participants to connect their capabilities with regional stakeholders and technology providers invested in building pathways to carbon neutrality in the region. In order to facilitate vibrant and candid discussions, the workshops are held under the Chatham House Rule, and outcomes are summarized to include input that is not attributed to any one participant.

Results from the technology-focused workshops will inform the final I-WEST report.



The interdependencies between hydrogen, carbon, and bioenergy economies demand a keen understanding of how they interact relative to workforce, common resource and infrastructure needs, and deployment timelines.

1.2 Workshop Attendees (Stakeholders only; attendees from I-WEST team not shown)

First Name	Last Name	Company Name	Job Title
Bonnie	Carr	AECOM	Chief Process Engineer
Peter	Montalvo	AECOM USA	Senior Project Manager
Jared	Walker	Battelle	Commercial CCUS Operations Manager
Michael	Matson	Carbon America	Vice President
Robert	Hamaker	Deseret Power	Operations Superintendent
Eric	Olsen	Deseret Power	VP, Chief Operating Officer
Jeff	Peterson	Deseret Power	House Counsel
Phil	Solomon	Deseret Power	Chief Engineer
Adam	Goff	8Rivers	Principal
Peter	Mandelstam	Enchant Energy	Chief Operating Officer
Alicia	Summers	Frontier Carbon Solutions LLC	Director of Engineering
Erik	Meuleman	ION Clean Energy	CTO
Taylor	Vactor	KeyLogic	Senior Scientist
Virgilio	Barrera	LafargeHolcim	Director, Government and Public Affairs
Matt	Eales	Lucid Energy Group	Vice President
Christopher	Davis	Milestone Environmental Services	VP, Carbon Sequestration
Shaun	Gee	Milestone Environmental Services	VP

First Name	Last Name	Company Name	Job Title
Brice	Freeman	MTR	Carbon Capture Product Manager
William	Barrett	Oxy Low Carbon Ventures	Commercial Director
Rich	Walje	RAW-Energy	Principal
Coy	Bryant	Red Cedar Gathering Company/Aka Energy Group	President & COO
Demi	Morishige	Red Cedar Gathering Company/Aka Energy Group	Financial Analyst
Ian	Andrews	SCS Energy	Consultant to SCS Energy
Claude	Letourneau	Svante Inc	President & CEO
Gordon	Criswell	Talen Montana	Director, Environmental & Compliance
Miken	Larson	Utah Iron, LLC	CFO
Lindsay	Leveen	Utah Iron, LLC	CTO
Daniel	Kim	Williams Companies	New Energy Ventures Business Development Lead

1.3 Workshop Agenda

Tuesday, November 30, 2021

Time	Topic	Presenter
8:00	Welcome, logistics, discussion leaders	George Guthrie
8:15	Panel introductions & welcome	Roundtable
8:30	Roundtable discussion: technical aspects	Moderators: Jim Gattiker & Raj Singh
9:45	Break; Audience welcome to submit questions to chat	Break
10:00	Roundtable discussion: social-economic and policy topics	Moderators: Janie Chermak and Alan Krupnick
11:45	Outlook for achieving net zero	George Guthrie
12:00	Conclusion	

1.4 Workshop Prompts/Questions

Discussion topics/questions for the 8:30a first roundtable discussion:

technical aspects

1. What is your primary driver for deploying carbon capture for your facility, or that led you to choose the project?
2. What technical challenges specific to your facility have you encountered?
3. What regional infrastructure/resources are critical enablers for your project?
4. What do you envision for the scale of point-source capture in the region by the end of the decade?
5. Which types of sources in the region can/cannot deploy carbon capture over the next 5 years? What specific characteristics do you think would enable those point sources as targets?
6. What technical barriers are limiting carbon capture deployment at large scale in the region? What technology advancement would further facilitate carbon capture deployment at point sources in the region?

Discussion topics/questions for the 10:00a second roundtable discussion:

economic/policy focus

1. How do the current and planned local/state/federal policies limit or facilitate deployment of carbon capture at regional point sources?
2. What is the societal acceptance of deployment of point source CO₂ capture in the region of your project and what are the challenges?
3. What are the financial constraints limiting large scale carbon capture in the region? Do you have suggestions on potential pathways to address financial constraints? What project operational lifespan (e.g., 10 yrs of operation) is needed for financial viability?
4. What are the economic impacts (e.g. jobs, revenue) of your carbon capture deployment project for the local community and state/region?
5. What were your considerations for issues such as access to skilled workforce?
6. What are your envisioned long-term prospects of carbon capture in regional net-zero?

1.5 Summary of Key Takeaways

This event was a fruitful discussion of the prospects, concerns, and needs of the stakeholders, whose interest in point-source capture (PSC) included deployed technology specialists, managers of PSC projects in various stages of completion, and point-source facility representatives seeking information. Several of these regional projects encompassing power and industrial point sources will come online in the near future. Participant projects and facilities included a broad range of point sources, from fossil electricity generation, cement, hydrogen production and ammonia, mining, NG treatment/processing, and other industrial capture. These projects are poised to start a new industrial era and bring extensive opportunities for the I-WEST region.

In general, the discussion focused less on the technology needs and options, indicating a sense by the project managers that deploying the capture technology itself is not the dominant concern. However, there was acknowledgment that the most mature projects would be pioneering the scale-up demonstration, and that a successful demonstration of capability will be critical to a broader recognition of the viability, particularly with respect to investment and public trust.

Considerable productive discussion was captured in this workshop, covering a range of issues including: sequestration, transportation, and land rights issues with regard to injection wells; permitting and regulation; ramping up manufacturing, both in terms of physical construction and craft and technical workforce availability; environmental considerations, including water requirements for cooling; long-term government support in capture credits and emissions penalties; and issues of public trust.

- I-West region emits nearly 400 million tons of CO₂ per year. The current on-going project at various stages of deployment are anticipated to capture ca. 12 million tons of CO₂ per year. Other facilities also mentioned interest in implementing CC and have ongoing assessment. The largest CC effort in the region is anticipated to be operational within a two-year time frame and hinges upon EPA timeline for sequestration well permit approval. The close proximity to transmission lines, water and feedstock source (e.g. natural gas) availability, and CO₂ transportation pipeline and sequestration well are major decision factors in selection of these facilities for CC deployment.
- In a discussion of the scope of PSC project deployment, carbon capture technology readiness did not come up as an issue. It was noted that medium-term goals of emissions reduction will require massive industrial deployment, on the order of project completions on a weekly basis. Concerns were expressed on both raw materials availability and specialist PSC technology materials availability, and similarly in the availability of craft and technical workforce for deployment and operation. Outsourcing to large industrial manufacturing companies is path-forward for achieving materials manufacturing at required scale.
- The downstream disposal of captured CO₂ was a dominant concern, with the consensus that in the project planning horizon the sole option is pipelines leading to sequestration sites. One general observation was the need to make carbon disposal an industry of its own, rather than the current practice of development of this capability for each project. In this area, the largest concerns are land ownership and land rights laws, particularly regarding the implications of subterranean plumes.
- Permitting and regulation certainly covers the application of PSC technology, but again the dominant aspect of this discussion is regarding sequestration. There was discussion from different

state representatives regarding the regional differences by state, making it clear the complications that come in regional planning without state engagement. The need for EPA workforce development for timely class-6 well permitting and approval for injection was echoed unanimously.

- In this region, water for cooling is a potentially significant issue. From a technical perspective, other cooling mechanisms (e.g. air cooling) are available, but impact the economic viability of projects and would require additional power availability. In addition, impaired water disposal including zero-liquid discharge water storage needs will need to be considered.
- In public trust, it is perceived that there is a broad sentiment that PSC deployment is, to paraphrase, life-extension of poor (dirty, non-green, etc) energy pathways, rather than a responsible component of the net-zero energy transition and energy future. It was emphasized that public outreach and education is needed in order to make initiating PSC projects attractive.
- In financing a project, it was broadly recognized that stable 45Q-like mechanisms for capture credit are critical to even get started. The role that emissions penalties can play in encouraging projects was also discussed.

Project managers recognized the critical positive impact that successful continuing energy projects will have to regional communities, including communities that otherwise have little economic option, as well as the stewardship and support of the health of tribal nations.

Many of these comments aren't directly regarding PSC technology. We recognized in the event introduction, and in general in the overall workshop enterprise, that there are many possible ways to try to break the roadmap process into segments. We would expect very strong dependencies between any approach to dividing the discussion to drill down into regional issues, and so expected discussion to range into related topics. This is particularly the case in the PSC area, where the technical capture and directly associated industrial deployment issues are arguably the most mature of the overall energy transition roadmap issues. The outcome of the workshop—the engagement of the community and the animated discussion captured—is a very positive start to the information discovery workshop process, and all of these issues will find a place in seeding the discussion of future events.