Big Sky Carbon Sequestration Partnership

Montana State University

Developing a CCS Project at a Greenfield site: a case example in northern Montana

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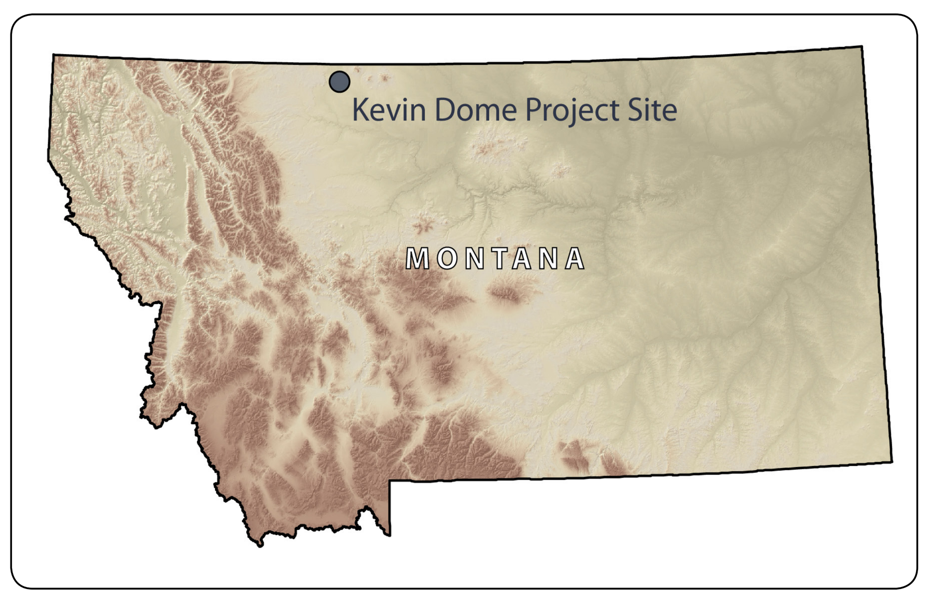
Introduction



Kevin Dome project area map

The Big Sky Carbon Sequestration Partnership (BSCSP) is conducting a large scale CCS demonstration project at an undeveloped greenfield site. The Kevin Dome Carbon Storage Project is located in north central Montana near the Canadian Border in Toole County. The project site is in a very rural area and is located away from community centers. The land is defined by wide open spaces with a few scattered homesteads nestled among large dryland farms. Conducting a CCS project in a greenfield site presents some opportunities and also some complexities that warrant additional planning. Unexpected issues are more likely to arise due to limited datasets and other unknown factors. This poster discusses lessons learned from a case study at Kevin Dome. The infrastructure needs for the project have required greater planning, permitting and construction timeframes. Transportation costs have been higher and there have been some limitations in the availability of service providers, labor and other goods and services. The datasets for site characterization are of mixed quality and are less comprehensive than in other regions around the country. This project has learned that it is critical to factor in data gaps when planning and conducting activities such as drilling and completing wells. It was also not possible to pursue an EPA Class VI permit simultaneous to infrastructure development, which has extended the overall project timeline significantly. Some landowners are more sensitive to changes in viewshed and environment from the activities associated with the Kevin Dome project site.

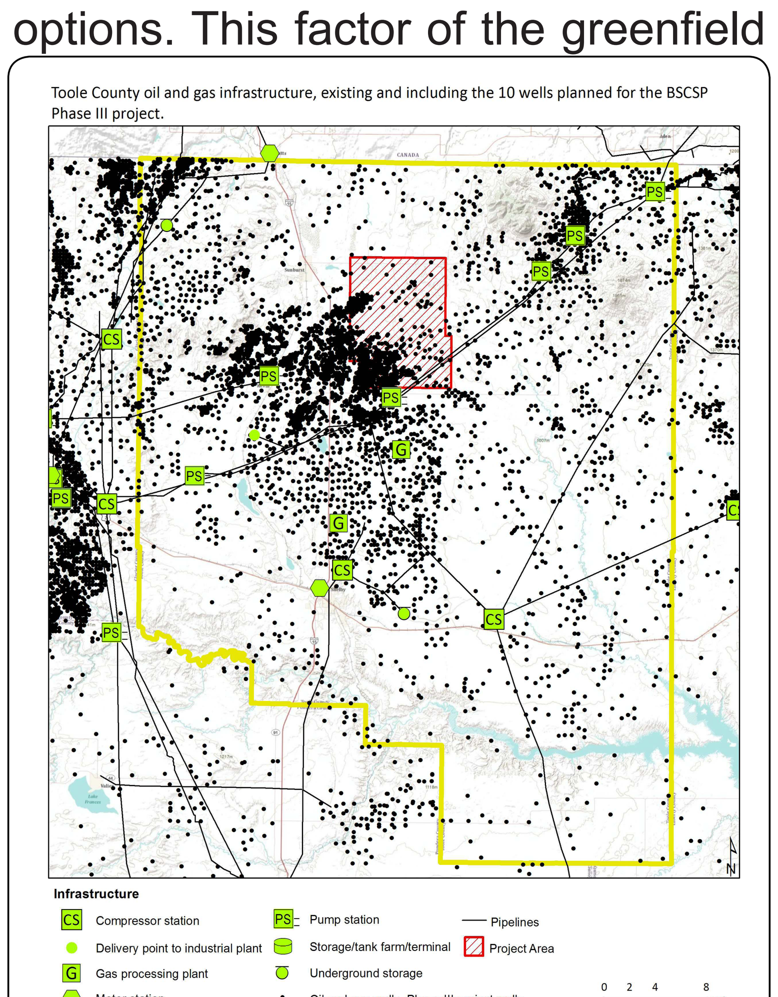
Data Availability

BSCSP's Kevin Dome site is undeveloped and data-poor when compared to other projects injecting into mature oil and gas fields. Existing geologic interpretations of the area showed promising conditions for both CO_2 production from the gas cap and injection into the water leg. However there was some uncertainty because well data for the zones of interest was limited. Most of the wells that penetrate the target zones were drilled prior to modern log suites, and formation testing results were often poorly documented. At a greenfield site such as this one, it is important to recognize the limitations of site data early in the characterization process and identify cost-effective methods to reduce uncertainty. Obtaining existing 2D seismic data helped confirm geologic structural trends modeled from well formation tops early in the project. Identifying areas of uncertainty related to subsurface characterization allowed BSCSP to plan for appropriate logging, core analysis, and testing to fill knowledge gaps in injection zone porosity, permeability and subsurface heterogeneity at a finer scale than the regional interpretations.

BSCSP conducting a 3-D seismic survey

Project Planning and Infrastructure

It is important to evaluate CO_2 transportation networks. At the Kevin Dome site, there are limited existing CO_2 pipelines in the region which has played a significant role in CO_2 sourcing options. This factor of the greenfield site posed both logistical and budgetary challenges since building CO_2 pipelines or transporting CO_2 by rail or truck is very expensive and can be limited by geographical features, costs, and permitting regulations. Analysis of the existing wells at any site is also important for site characterization and permit applications. Existing wells may also be repurposed for water quality, geochemical, and geophysical monitoring for cost savings. The condition of existing wells can also impact the budget. In the case of Kevin Dome, most of the wells that penetrate the injection zone were drilled over 80 years ago. Plugging records are vague, and costs to mitigate the old wells if they fall within the modeled UIC Class VI area of review should be taken into consideration.



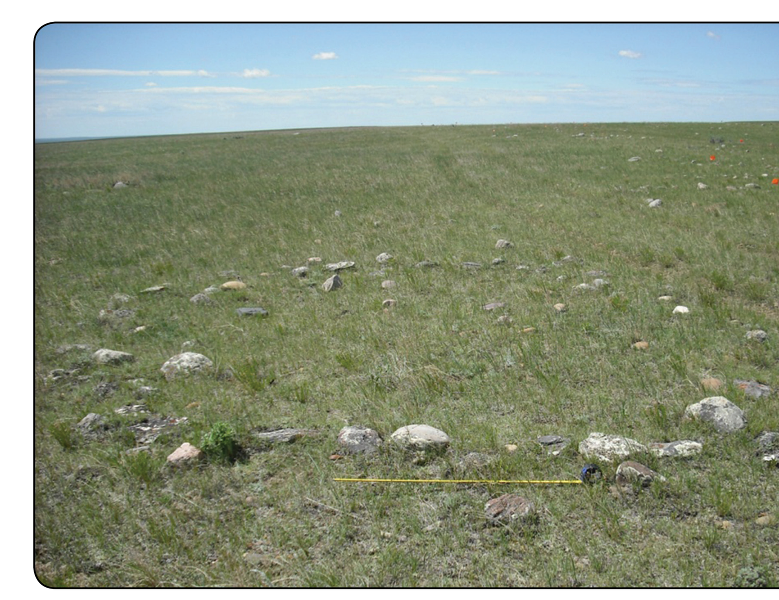
As a greenfield site, there was no existing power or water infrastructure at the well locations impacting operations and budget. The project is working with local landowners to bring three-phase power to the site and water msut be hauled in and stored in tanks. All waste water is transported offsite and disposed of in a disposal well.

Drilling first CO2 production well

Logistics

The nearest lodging to the site is approximately 30 miles. Trailers were brought in for on-site scientists and engineers to stay in during drilling operations. Other personnel stayed in Shelby, MT and commuted daily to the project site. Most of the project area doesn't have reliable cell phone service and sometimes the US mobile phone carriers switch to Canadian towers due to the proximity to the US-Canadian border. The project also doesn't have a landline, so telemetry options are limited. The project is considering bringing in a landline when it begins the injection phase.

Environmental and Cultural Resources



A stone circle in northern Montana

BSCSP was aware at project onset of protected environmental, biological and cultural resources in the field area; however, the quantity and quality of cultural resources was unknown. After consulting with the Montana State Historical Preservation Office, an on-the-ground cultural survey was requested. This survey revealed hundreds of cultural sites within the project boundary.
To ensure protection of the cultural and historic resources, BSCSP worked closely with DOE, Montana State Historic Preservation Office and representatives from tribes to develop a Programmatic Agreement (PA) that outlines the policies and procedures to avoid and minimize impacts to cultural resources for future project activities. Additionally, the project consulted with the US Fish and Wildlife Service to determine if there were any endangered or threatened species in the project area. It was determined that the project needed to adhere to several wildlife related stipulations to limit project effects on migratory birds, bald and golden eagles, black-footed ferrets, Sprague's pipit and grizzly bears. For example, project activities such as construction and seismic work, are scheduled to avoid the migratory and breeding season when possible. Other preventative actions include: avoiding preferred habitats, installing reflective bird tags on permanent guide-wires, using freshwater-based drilling muds, installing netting over reserve pits, and maintaining a clean work area free of trash that may attract bears or other wildlife to construction sites. Other seasonal factors include working around the timing of landowner farming activities like tilling, seeding and cropping. Due to the greenfield status of the site, these were unknown at the early planning stages and required additional time and budget allocation than originally expected.

EPA Class VI Permit

The greenfield nature of this site has greatly extended the timeline for obtaining an EPA Class VI permit because the background subsurface data wasn't already available; BSCSP had to permit and conduct a 3-D seismic survey and drill a characterization well to obtain the data. The result of this was a much longer Class VI permit timeline since the permit preparation couldn't be done in parallel with the site characterization and infrastructure development work.

Conclusions

Developing a greenfield site can greatly add to the knowledge base for conducting CCS projects in regions around the world that are less developed and have limited datasets. If greenfield sites are selected for a CCS or related project, managers should account for longer site characterization, permitting and planning phases. It has been important to analyze the factors discussed above to successfully implement the Kevin Dome Carbon Storage project.

A rural landscape within the project area

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