Enhancing Climate Resilience through Accelerated Regional Carbon Storage Deployment

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Carbon capture and storage (CCS) has emerged as the lynchpin for large-scale decarbonization strategies in recent years for meeting the mid-century carbon reduction goals. CCS has evolved from a primarily point-source power plant CO_2 abatement option to a broad-based technology applicable for point sources (power and industrial), CO_2 removal via direct air capture (DAC), transition to hydrogen-based energy, and biomass energy for possible net negative emission. As a consequence, the likely demand for viable storage resources in geologic formation has increased substantially. It is anticipated that the global CO_2 storage capacity will need to increase more than 100 fold in the next three decades. Meeting this demand will require systematic and in-depth exploration efforts for safe and reliable storage sites, similar to that done for oil and gas resources. This presentation will provide an example of one such systematic regional effort, the Midwest Regional Carbon Initiative (MRCI, midwestccus.org), a US Department of Energy-funded program to facilitate deployment of CCUS in the midwestern US.

The progress from the past 20 years of efforts as well as the plans for projects currently under development will be summarized to illustrate the commercial interest in full-scale deployment. These past efforts provide a take-off platform for the exponential growth in commercial deployment in the region. The increased interest is driven by several factors, primarily the enactment of the 45Q tax credits with a likelihood of further increase in the credit value, potential for climate regulations with increasing corporate commitments on net-zero emissions, and the federal investments under the US Infrastructure Bill and Jobs Act.
The MRCI is a broad coalition of partners dedicated to the study, acceptance, and acceleration of carbon storage and sequestration in the Midwest, Northeast, and Mid-Atlantic regions of the United States. The MRCI effort combines the former Midwest Geologic Sequestration Consortium (MGSC) and the former Midwest Regional Carbon Sequestration Partnership (MRCSP). Their nearly 20 years of research, including pilot- and full-scale projects, provided the foundation for validating that CCUS technologies can be commercially deployed and monitored in their coverage areas. Led by Battelle Memorial Institute and the Illinois State Geological Survey, the MRCI aims to advance CCS deployment by addressing key technical challenges, obtaining and sharing data to support CCUS, facilitating regional infrastructure planning, and performing regional technology transfer and engaging national and international stakeholders, including state geological surveys, universities, industrial partners and advisors, fossil fuel production and utilization companies, and NGOs.

The diverse region presents a wealth of opportunities for research and application of CCUS technologies, as it includes more than one-third of the nation's CO_2 point sources, accounting for more than 900 million metric tons of CO_2 annually. The energy economy and resulting emissions profile in the region is transitioning from a heavy reliance on coal, to abundant shale gas-based gas production, and now positioning for future sources from hydrogen economy and direct air capture. The geology of the region is also complex and diverse, covering multiple storage provinces and plays including the Michigan Basin, Illinois Basin, Appalachian Basin, Atlantic Coast, and Offshore. While the thick sedimentary columns offer potential for large-scale storage intervals with adequate caprocks, there is also the challenge of systematically mapping and qualifying storage resources for long-term storage. This is being done in collaboration with the state geological surveys, through compilation of existing and legacy data from oil and gas

exploration; classification of the region into numerous sub-regional CCUS systems; defining Precambrian basement faulting and stress to mitigate induced seismicity risk, developing detailed static and dynamic models; and conducting risk assessments. Results from this regional analysis will be presented. The MRCI is also partnering with various CCUS and subsurface injection projects to obtain valuable data for regional assessments. Machine learning techniques are also being applied to elicit storage parameters from oil/gas drilling related data. Finally, the MRCI has acquired and is analyzing legacy seismic survey and well data from regional oil and gas operators, that would otherwise have been disposed.

The successful implementation of CCUS will also require numerous regional and location infrastructure issues to be resolved. The MRCI program is (1) outlining the infrastructure requirements to implement CCUS; (2) characterizing the economic and social impacts of CCUS; and (3) evaluating the regulatory and policy needs in the multi-state study area, under multiple CCUS buildout scenarios in the region. In addition to existing sources and imminent topics, such as pipelines and regulations, there is also a strong emphasis on emerging topics, such as new sources from bioenergy with CCS (BECCS), direct air capture, blue hydrogen, and managing infrastructure vulnerability and security challenges. Finally, the MRCI has a significant stakeholder outreach component and a phased approach to reach a variety of stakeholders (local, regional, and federal policymakers; industry; technology developers; researchers; communities affected by energy transition; etc.)