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Through various efforts funded by the North Dakota Industrial Commission, the Energy & Environmental Research Center (EERC) has been evaluating different aspects of subsurface produced gas injection since 2017. The focus of the various efforts, which have been conducted in collaboration with industry partners, has been to evaluate subsurface gas storage and/or injection for oil recovery in conventional and unconventional oil reservoirs as a means of mitigating flaring and preserving the state's resources while allowing for ongoing development and production of oil from the Bakken petroleum system (Bakken).

The first effort evaluated by the EERC, in conjunction with Liberty Resources, was produced gas injection for enhanced oil recovery (EOR) in the Stomping Horse Field of the Bakken. The results of the pilot testing in the Stomping Horse Field and the key lessons learned are currently being applied to implement a second produced gas EOR pilot in a different Bakken field.

In 2018, the EERC received funding from NDIC to perform an initial evaluation of produced gas injection as a mechanism to mitigate flaring and to circumvent curtailed oil production in areas that had no available infrastructure to transport gas off-site to gas-processing facilities. Through that effort, a variety of different scenarios were evaluated, including produced gas storage in saline formations and other subsurface targets, as well as produced gas injection for EOR in conventional and unconventional oil fields. The key conclusion of that effort was that gas storage to alleviate flaring and circumvent curtailed Bakken oil production may be technically and economically viable, but that additional work was needed to implement pilot projects to fully evaluate the technical feasibility and to better understand the regulatory aspects that needed to be addressed prior to project permitting.

To further facilitate the evaluation of potential mechanisms to mitigate flaring, in 2019 the Sixty-Sixth Legislative Assembly of North Dakota included wording in Section 25 of House Bill 1014, which was signed into law by Governor Burgum, that states funding will be made available to the EERC for "pilot projects relating to the underground storage of produced natural gas." The overall goal of the ongoing effort has been to demonstrate the technological and economic feasibility of produced gas injection into non-hydrocarbon-producing subsurface formations in the Williston Basin for future recovery and use or for pressure maintenance and/or EOR in conventional or unconventional oil reservoirs. To achieve the goals that were intended by the legislature, the EERC has been partnering with North Dakota operators to evaluate various subsurface gas injection scenarios and, ultimately, to implement one or more pilot projects entailing gas injection either for storage or for EOR.

In July of 2019, the EERC worked closely with XTO Energy (XTO) on the assessment of two potential subsurface gas injection projects, including 1) produced gas storage in a saline formation and 2) produced gas EOR in the Bakken petroleum system. A thorough assessment of

the technical feasibility of gas storage/injection in these subsurface targets was evaluated by the EERC. The key conclusions of the assessment indicated that temporary produced gas storage in saline formations as a mechanism to store stranded gas and bring new Bakken wells online is technically and economically viable. Similarly, produced gas injection for EOR in the Bakken was also deemed beneficial if sufficient volumes of gas are injected. Throughout the evaluation, the EERC and XTO worked closely with the NDIC Department of Mineral Resources (DMR), the North Dakota Office of the State Tax Commissioner, the North Dakota Department of Trust Lands, and the U.S. Department of the Interior Bureau of Land Management (BLM) to define the key tax, royalty, and regulatory components that would need to be addressed to implement the project, including areas where regulatory clarity was needed with respect to implementation of gas storage projects.

In the fall of 2020, again with NDIC funding, the EERC performed an evaluation of natural gas liquid (NGL) storage in artificially created subsurface salt caverns. The key goal of the effort was to evaluate locations in western North Dakota where infrastructure and required resources are colocated with salt formations that may be suitable candidates for NGL storage caverns. The ability to effectively store large volumes of NGLs is a prerequisite for petrochemical development, which could provide value-added products using North Dakota's produced gas. The initial results of the study suggest that the development of small caverns is achievable in North Dakota salt beds and that multiple caverns could be used as a viable design approach to support NGL storage. As is the case with produced gas storage, several areas of regulatory uncertainty were identified that could affect the development of salt cavern storage projects in North Dakota.

Moving forward, the EERC is working with a large publicly traded company and two smaller private equity-backed companies on the evaluation of multiple gas storage/injection pilot projects. In each of these efforts, the EERC is assisting our industry partners with the technical evaluation of the concepts, as well as with the permitting process and project implementation if the concepts appear technically and economically viable. Each of the proposed efforts will help build our knowledge of the technical and economic feasibility of various produced gas storage/injection approaches as mechanisms to reduce flaring and preserve the state's natural resources.

Having regulatory clarity for each of the potential produced gas or NGL storage approaches is critical for providing industry with the information needed to make decisions on the viability of project implementation. Ultimately, the option to economically store gas or NGLs in the subsurface to facilitate Bakken oil production, to reduce flaring, to support EOR, and to attract the petrochemical industry to North Dakota provides economic and environmental benefit to the people of North Dakota and its industries. It underscores the importance of this bill and its passage.