Development of a Commercial Scale Integrated CCUS Demonstration Project in the Ordos Basin, China

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The objective of the project is to build a scientific, technological, and engineering framework necessary for a commercial scale integrated demonstration project including CO2 capture, CO2 handling (compression and transportation), CO2 utilization (EOR/EWR/Fracking), displaced water life cycle analysis and treatment, and CO2 geological storage. This joint study focuses on: 1) evaluate the technologic, engineering, economic, and financial feasibilities of a commercial-scale integrated CCUS project; 2) assess the research gaps, develop and validate technologies for implementing commercial scale integrated CCUS project; 3) utilize CO2 from the coal-to-chemical facilities to support CO2-EOR/storage projects; and 4) develop an integrate CO2-EOR projects with commercial-scale CO2 storage.

The Ordos Basin is one of largest energy center in China for developing a commercial scale integrated CCUS project with following advantages. 1) A craton basin with the most stable tectonic and simple structure in China; 2) The coal deposits in the Ordos Basin account for 39% of total national coal resources (3.98 trillion tonnes) and proven reserve is 366.7 Bt; 3) Stacked oil/gas/saline reservoirs with huge storage capacities (over 100 Gt); 4) Abundant stranded oil reserves (1.2 Bt) that can be economically recovered by CO2 flooding; 5) Over 50 Mt/year of high-concentration (>90%), lower-capture cost CO2 are available for commercial scale CCUS project; 6) Fast developing of coal chemical and petroleum industries require new water resources – CO2 enhanced water recovery opportunity; 7) National/international support and international cooperation platform; and 8) With similar energy resource portfolio, the lessons learned from this demonstration project could help Wyoming greatly for developing a sustainable, low carbon economy.

In this feasibility study, the techno-economic evaluation of a large-scale integrated CCUS project in the Ordos Basin is conducted, a workflow for geological CO2 storage and utilization site characterization is established, and an integrated energy/CCUS development strategy for energy rich regions such as the Ordos Basin is designed.

The techno-economic feature of a potential CCUS project in the Ordos Basin is assessed using techno-economic evaluation with preliminary technical design and budget-type economic model. The preliminary plan is to use 40% of total captured CO2 for CO2-EOR and the rest 60% for CO2-storage/EWR. The preliminary result shows that the mean value levelized cost of a full-chain CCUS project is -13.5 USD/t with standard variation σ=3.1 USD/t. In the other words, the results of technical-economic evaluation shows that the levelized cost of the integrated CCUS projects involving low-capture cost, high-concentration CO2 from coal chemistry industry sources can
obtain revenue from CCUS project mostly through oil sale. But total cost of CCUS projects are very sensitive to input coefficients, such as higher oil price, better geological conditions, lower capture cost, short transportation distance, large scale transportation pipe line, and so on. Therefore, the coal chemical industries developments near the mature oil fields in the Ordos Basin provide attractive early opportunities to deploy and accelerate the scaling-up of CCUS projects within China in the near future.