

Comparative Analysis of Transport and Storage Options from a CO₂- Source Perspective

Tim Grant¹, David Morgan¹, Donald Remson¹, Allison Guinan², Chung Yan Shih², ShangMin Lin³, and Derek Vikara⁴

¹National Energy Technology Laboratory

²Leidos, Inc., National Energy Technology Laboratory

³Deloitte, National Energy Technology Laboratory

⁴KeyLogic Systems, Inc., National Energy Technology Laboratory

ABSTRACT

Transport and storage costs are critical for any source in their effort to keep overall carbon capture and storage (CCS) costs at a minimum. For the source, cost effective storage is a combination of suitable storage and transportation sufficient to accommodate the total mass of CO₂ to be sequestered. The Department of Energy's National Energy Technology Laboratory (NETL) recently completed a comparative analysis on the selection of a suitable saline storage reservoir in conjunction with transportation by a dedicated pipeline or a trunkline system from the perspective of the CO₂ source. This study combines costs for capture, transportation, and storage for a collective evaluation on the cost of CCS and tests the methodology for analyzing combined CCS costs and selecting proximal storage for sources capturing different masses of CO₂. Component cost within the CCS value chain has been calculated at different annual rates of CO₂ captured for different sources modeled over a 30-year period. Capture costs modeled are for three super critical pulverized coal power plants (550 MW, 482 MW, and 400 MW net power output) and three industrial plants: steel, cement and natural gas processing. Annual capture ranged from 3.90 to 0.65 million tonnes per year. Seven reservoirs were selected for modeling. The Rose Run 3 and 4 reservoirs are in western Pennsylvania within the Appalachian Basin. The modeled sources are within 100 and 200 kilometers (km) of either Rose Run reservoir. Further away, the Mt. Simon 10 reservoir is located on the western edge of the Appalachian Basin in western Ohio, the Mt. Simon 6 reservoir is on the platform between the Appalachian and Illinois basins in central Indiana, and the Mt. Simon 3 is within the Illinois Basin in central Illinois. The other two reservoirs are in the Gulf Coast Basin: the Lower Tuscaloosa 8 reservoir in west-central Mississippi and the Frio 3a reservoir in the upper Texas Gulf Coast. Each reservoir was modeled for both a dome and regional dip structural setting. The dedicated pipeline system modeled connects a single source to its storage site. With a trunkline, each source needs its own gathering pipeline to connect to the trunkline and a distribution pipeline to connect between the trunkline and storage site. Cost effective CCS depends on the total mass of CO₂ captured and stored which in turn depends on the annual rate of capture, transport distance, and project life.