Carbon Storage Technical Viability Approach (CS TVA) Matrix: Integrating Multiple Components for Comprehensive Scoping and Data Availability Assessments

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Abstract

The National Energy Technology Laboratory (NETL) has been working to develop tools and curate publicly available datasets to support and facilitate geologic carbon storage (GCS) in the United States to support emissions reduction and energy transition goals. Historically, GCS research has developed workflows for volume assessments and economic project feasibility have been developed and advanced, providing necessary and useful tools to progress GCS projects. These workflows and assessments have focused primarily on determining the in situ storage resource based on geologic and engineering parameters and do not integrate subsurface characterization with surface conditions, social factors, and environmental factors that may pose a benefit or impediment to the implementation of GCS. Furthermore, the data required to assess the technical viability of GCS are myriad and disparate. There is no current methodology that identifies technical viability criteria and systematically informs how to aggregate these factors for spatial assessments. To address this gap, NETL has developed a Carbon Storage Technical Viability Approach (CS TVA) Matrix and Data Availability Assessment Workflow and corresponding database. The CS TVA Matrix establishes the data types necessary for GCS analysis and assesses the viability of each component. The CS TVA matrix defines broad categories: reservoir capacity, retention and seal integrity, hazards, land use, regulations, environmental justice and social and social justice, as well as specific components within each category. These data can then be combined to spatially summarize GCS technical viability based on the information available. The CS TVA establishes the common criteria required for technically viable GCS and allows stakeholders to integrate additional components as needed to comprehensively assess data availability. In addition, a workflow and comprehensive database have been developed to assess GCS data availability spatially. The workflow leverages data science analytics to illustrate data availability and gaps. Preliminary results highlight inconsistencies between data types, both spatially and categorically across potential U.S. GCS basins. Generally, data are abundant in areas where subsurface energy operations have previously taken place. The identified data gaps can inform where additional data collection efforts are necessary, while also indicating where existing data resources support comprehensive assessments of CS technical viability. The CS TVA Database v1.0 is an aggregation of a variety of other NETL Database products combined for analysis. This workflow, database, and matrix provide guidance to those interested in advancing specific CS projects through providing a high-level understanding of viability as well as insight into current data gaps and limitations.