

Life Cycle Analyses of Point Source Carbon Capture and CO₂ Destinations at the National Energy Technology Laboratory

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Background/Objectives. The National Energy Technology Laboratory (NETL) recognizes that carbon capture can be a powerful tool to transform not only our electric grid but other industrial sources such as cement and iron/steel manufacturing. As such, NETL has been performing analyses on point source carbon capture, namely power plants, and potential CO₂ destinations, such as saline aquifers and in enhanced oil recovery. These analyses include techno-economics analyses (TEAs) and life cycle analyses (LCAs). And to complete the picture NETL has also been providing information on carbon storage, from resource assessment (Carbon Storage Atlas) to cost models. The life cycle analysis team at NETL is charged with putting all these pieces together to provide a holistic view of the potential environmental impacts for carbon capture utilization and storage (CCUS) systems. This presentation will summarize the NETL LCA work in CCUS over the past year and provide information on some upcoming tools.

Approach/Activities. Bioenergy with carbon capture and storage (BECCS) and Coal/BECCS (CBECCS) systems are necessary to avert global temperature increases in some modeled Intergovernmental Panel on Climate Change (IPCC) Shared Socioeconomic Pathways (SSPs). Co-firing coal and biomass can drastically reduce the amount of biomass needed to produce power while remaining net carbon negative on a life cycle basis. NETL also finalized LCA profiles for steel, natural gas processing, and cement plants with carbon capture.

CO₂ utilization has been a big area of focus for NETL in the past few years. This year NETL updated the CO₂ Utilization Guidance Document to provide more options for CO₂ sources, which is commensurate with shifts for more recent funding opportunity announcements. These changes to the guidance document are accompanied by updates to our CO₂ utilization database as well. Moreover, NETL developed additional guidance for 45Q taxpayers that are using the guidance document and tools to perform their LCAs for carbon oxide capture and utilization systems.

NETL also finalized a new saline storage model that leverages the FECM/NETL CO₂ Saline Storage Cost Model to provide the necessary activity data (number of monitoring wells, periodic surface monitoring requirements, etc.) for our LCAs using a new Saline Storage LCA model. Because the cost model provides results for many potential domestic formations, the LCA model also provides formation-level results.

Results/Lessons Learned. NETL is committed to providing data, guidance, and tools that will enable the LCA community to effectively model CCUS. These materials and our unit process library are available on the NETL LCA team website – netl.doe.gov/LCA.