LCRI LOW-CARBON RESOURCES INITIATIVE

EPRI GTI ENERGY

EXECUTIVE SUMMARY

EASTERN SEABOARD CO_2 TRUNKLINE STUDY

PRIMARY AUDIENCE: Utility resource planners

SECONDARY AUDIENCE: Carbon capture, transport, and storage project developers and policymakers

KEY RESEARCH QUESTION

Decarbonizing the electricity sector requires large-scale carbon dioxide (CO_2) capture and storage (CCS) infrastructure deployment across diverse geographic regions. CO_2 storage depends on favorable geologic conditions, which, among other factors, require high-capacity, transmissive rock formations that store the injected CO_2 and an extensive, overlying, low-permeable caprock that serves as a barrier, thus keeping the buoyant CO_2 in the storage reservoir. Unfortunately, favorable geology is not distributed uniformly across all regions of the globe. A case in point is the Eastern Seaboard region of the United States, ranging from New York to Florida, where onshore storage opportunities along the Piedmont are relatively poor. In addition, heavily populated areas like New York City create additional challenges for safely transporting CO_2 through urban centers where CO_2 pipelines may not be easy to permit and construct. Alternative forms of transport by barge or ship may be needed if seaports are available in these highly urbanized areas. This project seeks to determine the integrated cost of capture, barge and pipeline transport, and CO_2 storage costs to evaluate tradeoffs between storing CO_2 in a geologically constrained region and/or transporting the CO_2 further afield to an adjacent region with favorable geology. The Eastern Seaboard region was selected as a case study for this reason.

RESEARCH OVERVIEW

This report explores CCS infrastructure planning options for the Eastern Seaboard region. Work was performed in the following four tasks:

1. The research team identified opportunities for capturing CO_2 at power and industrial facilities within the region and determined the capture cost.
2. The team identified CO_2 storage resources on the Eastern Seaboard and in surrounding regions, including offshore Atlantic, offshore Gulf of Mexico, onshore Gulf Coast, and onshore Appalachia and Midwest, and estimated storage costs by region.
3. The team gathered and developed data to support the planning of CO_2 transport via pipeline and barge/ship.
4. The team combined the results of the first three tasks and used linear optimization and scenario analysis to plan infrastructure for capturing, transporting, and storing CO_2.

KEY FINDINGS

Fourteen cost scenarios were developed, producing the following key findings from the full report:

- Over 276 million metric tonnes of CO_2 per year ($MtCO_2/yr$) are available for capture from electric generation facilities and 88 $MtCO_2/yr$ from industrial facilities within the Eastern Seaboard region.
- For electric generation facilities, pulverized coal power plants provide the lowest CO_2 capture cost at $43.76 per metric tonne ($/tCO_2$) due to high CO_2 capture volumes.
- For industrial facilities, pulp and paper mills have large total emissions volumes and low estimated capture costs at $60.39/tCO_2$, largely due to the low cost ($54.0/tCO_2$) of capturing biogenic emissions from these facilities. Lower-cost emissions are available from chemical facilities (which include ethanol production), petrochemical plants, lime and gypsum plants (which include calcium carbonate process emissions), and natural gas processing plants.
- The cumulative storage capacity for the onshore Eastern Seaboard is >500 billion metric tonnes ($GtCO_2$); over 90% of this capacity is in Florida and south Georgia.
- Transport costs range from $8–$20/tCO_2 across all scenarios. Transport costs are generally less expensive when utilizing onshore storage than offshore and less expensive when barging is considered along with pipeline transport.
- Several recurring trends were found during the integrated scenario analysis, including forming micro-pipeline networks linking CO_2 sources to geologic sinks in Florida and medium clusters of sources in other regions that would connect based on the scenario by pipeline to different sinks.
- A comparison of scenarios found that several common trunklines emerged. This study identified the following potential trunklines:
  - A connection between the Eastern Seaboard and low-cost storage sites in Indiana or Kentucky
  - A trunkline that consolidates all CO_2 emissions from the northern Eastern Seaboard and follows the Appalachian Mountains, leading to storage in the onshore Gulf Coast region while also capturing additional CO_2 along the route
  - A trunkline dedicated to the collection of captured CO_2 in Florida, western Georgia, and the Carolinas that leads to storage in Florida

WHY THIS MATTERS

This study's research tools and methodologies illustrate how integrated carbon-capture, transport, and storage techno-economic models can be applied and the outcome used to plan future CCS infrastructure needs.

HOW TO APPLY RESULTS

Resource planners can apply the results to identify CO_2 storage resources in their region and identify strategic industries or sectors that, when emissions are combined, could provide economies of scale for transporting and storing CO_2.

LEARNING AND ENGAGEMENT OPPORTUNITIES

The study results can be used to inform and engage with policymakers and regulators.

The Low-Carbon Resources Initiative

This report was published under the Low-Carbon Resources Initiative (LCRI), a joint effort of EPRI and GTI Energy addressing the need to accelerate development and deployment of low- and zero-carbon energy technologies. The LCRI is targeting advances in the production, distribution, and application of low-carbon energy carriers and the cross-cutting technologies that enable their integration at scale. These energy carriers, which include hydrogen, ammonia, synthetic fuels, and biofuels, are needed to enable affordable pathways to economy-wide decarbonization by mid-century. For more information, visit www.LowCarbonLCRI.com.

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