GTI ENERGY

GTI ENERGY RAISE
Reliable Affordable Infrastructure for Secure Energy

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EXECUTIVE SUMMARY

Utilizing Gulf Coast Natural Gas Infrastructure for Emerging Fuels

Background on RAISE

GTI Energy created the Reliable Affordable Infrastructure for Secure Energy (RAISE) collaborative to identify the most valuable opportunities for leveraging natural gas infrastructure to reduce emissions and spur economic growth. In a series of regional case studies, RAISE is mapping technology pathways, total costs, and life-cycle emissions of emerging fuels — hydrogen (H_2), renewable natural gas (RNG), and synthetic natural gas (SNG) — out to 2050. By modeling future energy scenarios and analyzing today's pipelines, processing facilities, and storage systems, RAISE provides a roadmap for leveraging existing and new gas infrastructure to enhance energy security and expand adoption of low-carbon emerging fuels. These insights provide key decision-makers with a system-level view of where, how, and why to prioritize investments. They also offer recommendations for focus areas to de-risk deployment, modernize infrastructure, and guide policy and capital flow.

Gulf Coast Region Case Study — Overview

The first of five regions, RAISE's Gulf Coast case study covers New Mexico, Texas, Arkansas, Louisiana, Mississippi, and Alabama. Conducted from July 2024 to March 2025, RAISE utilized National Energy Modeling System (NEMS) — a nationally recognized modeling framework that also underpins the Energy Information Administration's (EIA) energy outlooks — to provide a comprehensive cost-benefit analysis (CBA) of integrating emerging fuels. The case study methodology was conducted at the state level and included:

- Technoeconomic and lifecycle emission analyses of sixteen different fuel production pathways for H_2 (8), RNG (4), and SNG (4), considering regional resource availability
- Integrated optimization analysis under different scenarios to understand system-level interactions and trade-offs, and determine deployment strategies, energy supply mixes, and levelized cost estimates through 2050
- Side-by-side analysis of optimization results with state-level policy and regulatory landscape to identify key recommendations for policy support and investments to support the adoption of emerging fuels in the Gulf Coast region and address technical R&D gaps

Key Findings

Reimagining the Gulf Coast gas infrastructure offers a path for accelerated emerging fuel deployment, promoting energy security and cost-effective development, faster emissions reduction, and avoiding stranded assets.

- When comparing new construction, retrofit, and decommissioning options, the financial case for repurposing existing infrastructure is evident. Repurposing infrastructure allows for the avoidance of right-of-way acquisition logistics and the reduction of construction emissions.
- Repurposing natural gas pipelines for H_2 is estimated at 10–35% the cost of new builds. It is estimated that a new H_2 pipeline in the Gulf Coast costs $953,000 to $25.2 million per mile. Based on data from EIA's Natural Gas Pipeline Projects tracker, our analysis estimates the potential cost for repurposing pipelines in the Gulf Coast as $334,000 to $8.8 million per mile. In contrast, EIA data estimates decommission costs at $6.5 million per mile. Actual costs will depend on factors such as pipeline diameter, location, material type, and condition of the pipeline. Using existing rights-of-way can streamline permitting and environmental reviews, accelerate project timelines, and reduce construction-related emissions.
- While the levelized cost of carbon capture from fossil fuel sources is lower than that of H_2 production or other emerging fuel pathways involving carbon capture, prioritizing dedicated infrastructure for fossil-based capture does not preclude expanding H_2 capacity. Both approaches rely heavily on robust CO_2 transport networks, which underscores the value of shared infrastructure.
- Unlocking the full potential of industrial CO_2 capture requires enabling long-distance transport to appropriate storage and conversion sites. A key priority is linking the western pipeline cluster in Texas and New Mexico with the eastern cluster in Louisiana and Mississippi. This connection would streamline the movement of captured CO_2 between major industrial centers and storage sites and facilitate CO_2 use in chemicals production at existing carbon conversion facilities.
- Texas and Louisiana would benefit the most from access to low-carbon H_2 to reduce emissions from ammonia production, petroleum refining, and other industrial markets. States that have a higher total energy consumption to total in-state energy production ratio, such as Mississippi, Alabama, and Arkansas, can

particularly benefit from scaling emerging fuels to improve energy reliability in the future.

- RNG, particularly biodigester-based RNG, is the most promising emerging fuel technology in the region. Arkansas is a prime location for this type of technology due to high natural gas prices (>$9/MMCF) in some areas and a large quantity of available biomass.

The Gulf Coast is uniquely positioned to deploy and integrate H_2, RNG, and SNG with abundant in-region feedstock and a robust network of gas infrastructure.

- Already accounting for one-third of the nation's H_2 production, the region's H_2 capacity is set to expand significantly with the HyVelocity Hub. Low-carbon H_2 produced through advanced reforming (e.g., steam methane reforming and autothermal reforming) combined with carbon capture is the most cost-competitive in Texas and Louisiana (i.e., estimated levelized costs of $1.40 to 1.68/kg). Reforming technologies could become more economically competitive with further research to reduce costs through a combination of lower feedstock costs, higher yields, lower technology costs, and more robust supply chains.
- The region's extensive and mature industrial base is conducive to the production of SNG with significant potential CO_2 availability. Resources like widespread power plants and industrial sources could encourage the development of CO_2 capture markets and benefit other emerging fuel production pathways involving carbon capture. However, improving SNG cost competitiveness will require utilization of lower-cost sources of low-carbon H_2, such as natural gas SMR/ATR with CCS or advancements in low-cost electrolysis technologies.
- The region has over 55 million tons of biomass, representing a maximum RNG production potential of approximately 0.67 Tcf/year (1.84 Bcf/d). For context, the region's natural gas consumption in 2023 was over 3.62 Tcf (10 Bcf/d), highlighting the significant but partial role RNG could play in meeting energy demand.
- The Arkansas Delta is a prime candidate for RNG plants due to biomass availability and >$9/MMBtu gas prices. The economics of landfill gas is especially attractive given its ready integration into existing gas networks. Texas alone currently generates 0.37 Bcf/d of landfill gas from over two million tons of landfill waste across 161 sites, accounting for two-thirds of the region's landfill energy

potential. This fuel pathway in Texas is the most cost-competitive of the RNG and SNG pathways at $32.8/MMBtu.

- Overall, Texas shows the most favorable costs for natural gas-based H_2 due to its lower natural gas prices and CO_2 transmission and storage costs, while Mississippi, New Mexico, and Texas show the most competitive costs for electrolytic H_2 due to their abundant wind- and solar-based electricity resources.

Emerging fuels offer considerable emission reduction potential, contingent on costs, infrastructure, and technology development. This can complement renewable energy expansion.

- Emissions benefits of utilizing lower carbon fuels are substantial, especially when low-carbon H_2 or low-carbon electricity is used, but infrastructure and technology constraints (such as fuel purity for fuel cell electric vehicles) remain challenges. Continued research can drive future costs down and enable practical capture of these emissions benefits.
- The region has significant renewable energy generation potential with wind in Texas, solar across the region, hydroelectric power in Alabama and Arkansas, and geothermal sources in Texas and New Mexico. These factors facilitate electrolysis-based H_2 production, which is a less cost-effective H_2 production pathway compared to the lowest cost technologies like SMR and ATR. However, coupling electrolysis-based H_2 production with renewable energy infrastructure can improve electricity generation capacity factors through energy storage of excess H_2 produced and helps address renewable energy's intermittency and consequent impact on grid stability.
- RNG has significant potential to reduce emissions when sourced through anaerobic digestion of MSW.
- The lowest-cost H_2 production pathways include natural gas SMR with CCS, ATR with CCS, and plasma pyrolysis. These options benefit from the region's low-cost natural gas and the ability to scale to commercial capacities. Electrolysis remains a high-cost option in the region largely due to a combination of high capital expenditures and electricity-related operating costs, driven by price volatility and intermittency of renewables.
- Among all H_2 delivery methods, liquefaction is the most GHG-intensive, often approaching or exceeding production-related emissions. In contrast, compression, trucking, and pipeline delivery contribute relatively minor

emissions, though pipeline delivery includes construction and operational fugitive gases.

Currently, substantial policy incentives[1] are required to enable all emerging fuels to be economically competitive, with SNG requiring the highest incentive and RNG the lowest.

- Our results show that H_2 pathways require $400 to $900/ton CO_2 to 'break-even' depending on the production technology. While plasma pyrolysis was estimated to require the lowest incentive (benefiting from the region's low-cost natural gas and potential for commercial scalability), it remains an early-stage technology at this time. Electrolysis remains a high-cost option in the region due to a combination of high capital expenditures and electricity-related operating costs, driven by price volatility and intermittency of renewables. As a result, electrolysis-based H_2 is currently less competitive due to the lack of targeted incentives or low-cost electricity available.
- The complexity of SNG's inputs (electrolytic H_2 and CO_2 process feed) requires incentives of $800 - $1,150/ton CO_2 to support its adoption. The LCA results suggest that there is no economic advantage to producing SNG over fossil-based natural gas when using electrolytic H_2 as the feedstock. However, further modeling with a lower-cost low-carbon H_2 feedstock may reveal that SNG could be a more cost-competitive pathway than current results.
- The model suggests RNG prices of $25/MMBtu are possible in the long-term (beginning in 2028), requiring the lower policy incentive of $350/ton CO_2. However, this is dependent on the assumption of freely available municipal solid waste and relatively low-cost biodigesters.
- Based on the promising economic profiles seen from the TEA, LCA, and optimization modeling results for plasma pyrolysis-based H_2 and MSW-based RNG, research investments toward larger-scale and more efficient biodigester and/or thermal biomass gasifier technologies could reduce the fuel production cost and foster the adoption of H_2 and RNG in the Gulf Coast.

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[1] The case study modeled the CO_2 price required for emerging fuel technology pathways to reach cost parity with natural gas.