

NUFRIEND Insights

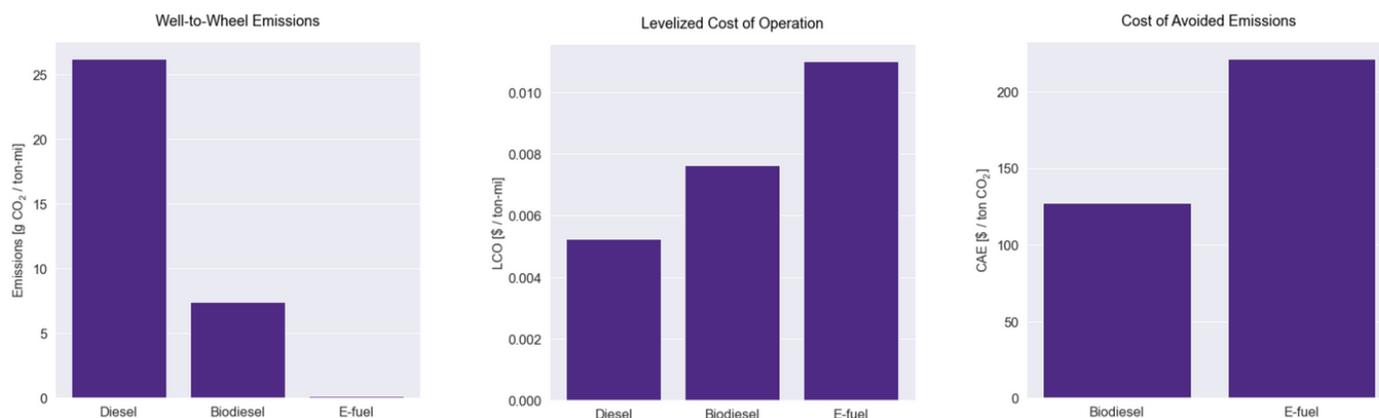
ENERGY TECHNOLOGIES - BIODIESEL VS E-FUEL

Northwestern University Freight Rail Infrastructure & Energy Network Decarbonization (NUFRIEND) is a comprehensive industry-oriented tool to simulate the deployment of new energy technologies across U.S. freight rail networks. Scenario-specific simulation and optimization modules provide estimates for carbon reductions, capital investments, costs of carbon reductions, and operational impacts for any given deployment profile.

WHY ARE DROP-IN FUELS PROMISING FOR RAIL?

- Drop-in fuels require little to no investments in asset or infrastructure upgrades for their deployment.
- Liquid hydrocarbon fuels are very energy dense and do not require additional fuel storage tender cars for locomotives.

This NUFRIEND Insights analyzes the potential benefits of drop-in fuels such as biodiesels and e-fuels in terms of their costs, emissions, and supply forecasts.



Life-cycle emissions, levelized costs, and costs of avoided emissions of biodiesel and e-fuels relative to diesel fuel.¹

TRADING OFF EMISSIONS AND COSTS OF DROP-IN FUELS

Drop-in fuels can provide significant emissions reductions, but are high cost as demand exceeds their current production. 3 billion gallons of diesel were consumed by the seven Class I railroads in 2020.

Biodiesel:

- Produced from organic waste matter.
- Constrained to substitute at most 40% diesel for current locomotives.
- 1.8 billion gallons produced in the US in 2020.²
- Cost of avoided emissions in line with forecast carbon credit pricing range.

E-fuel:

- Produced using electricity to convert captured carbon.
- Able to substitute diesel fully in current locomotives.
- Near zero production levels in US in 2020.
- Near zero-emissions fuel requires renewable zero-carbon electricity is used for production.

SUMMARY

- Drop-in fuels provide an opportunity to decarbonize energy-intensive line-haul routes with little to no capital investment.
- Testing on locomotives and refueling stations is needed to determine the impacts of any differences in chemical composition on equipment operations and lifetime.
- Aggressive steps to scale up production of biodiesel and e-fuels are needed to make them cost-competitive with diesel.

¹ The cost of avoided emissions measures the average cost required to reduce emissions by one ton of CO₂ and serves as a strong evaluation and policy metric. ² EIA

NUFRIEND Insights for:

RAILROADS

- Benefit of testing different fuel blends in operations.
- Importance to forecast future fuel needs and prices.
- Drop-in fuels provide flexibility for combinations of fuel technologies.

OEMS

- Benefit of testing different fuel blends on locomotive powertrains and operations.
- Development of emissions measurement tools.

FUEL & ENERGY PROVIDERS

- Need for scaling up production of alternative drop-in fuels.
- Collaboration with utility companies to ensure sourcing of green electricity.

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