



Project Spotlight: Red Trail Energy



RED TRAIL
— ENERGY —

Building on a history of innovation, Red Trail Energy is the first ethanol producer to enter the voluntary carbon markets - and the largest carbon removal project registered to date.

RTE was able to capture and store more than
150,000
tonnes of climate pollution that would have been released into the atmosphere

Red Trail Energy LLC (RTE), a 64 million-gallon-per-year corn ethanol production facility near Richardton, North Dakota, became the first producer in the U.S. to generate carbon dioxide (CO₂) Removal Certificates (CORCs) in the Puro.earth registry for capturing and injecting the CO₂ produced during the fermentation process at its plant. RTE captures the CO₂, which would otherwise be emitted into the atmosphere, and injects it for permanent storage into an underground Class VI well located approximately 6,500 feet directly beneath its facility.

This case study demonstrates the opportunity for corn ethanol producers in the U.S. to take advantage of voluntary carbon markets (VCMs) and create alternate revenue streams that reduce project risks and create optionality for bioenergy with carbon capture and storage (BECCS) projects.

Current incentive programs in the U.S. such as the 45Q federal tax credit for carbon capture and storage (CCS) and state low-carbon fuel standards (LCFS) that allow credits based on the carbon intensity (CI) of the ethanol produced are attractive to ethanol producers, but long permitting times and regulatory risks that impact credit pricing pose barriers for ethanol producers from making the investment. VCM credits can supplement federal tax credits and state LCFS credit programs, potentially becoming the missing piece to complete the puzzle and bring more BECCS projects online.

Background

BECCS projects involve capturing and permanently storing CO₂ from processes where biomass is converted into fuels. According to the International Energy Agency (IEA), BECCS is needed to decarbonize sectors such as heavy industry, aviation, and trucking if the world is to achieve net zero by 2050.¹

U.S. ethanol producers are prime candidates for BECCS - an abundant feedstock of corn that absorbs CO₂ as they grow, and the ethanol fermentation process produces a 99% pure stream of CO₂ as a byproduct. An ethanol producer that captures this CO₂ and permanently stores it is removing CO₂ that was originally in the atmosphere while also creating a biofuel that displaces petroleum.

Optionality is the ability to select a destination among multiple outlets, based on desirable market conditions. RTE, by registering CCS pathways in several jurisdictions and alternative voluntary carbon markets, garnered the choice to attach the CCS credits to the fuel product and sell its ethanol for a premium or to separate the CCS credits from the fuel and sell them as CDR credits into the demand heavy VCM.

¹<https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/bioenergy-with-carbon-capture-and-storage>

RTE's story begins in 2007, when it built a \$99 million state-of-the-art corn-ethanol production facility in central North Dakota.

Originally one of the first coal-fired ethanol producers in the U.S., RTE converted it to run on natural gas in 2016. Then followed six years of research, development, and investments into carbon capture and storage at the Broom Creek Formation, culminating in the submission of a Class VI permit application and receiving authorization to inject from the North Dakota Industrial Commission (NDIC).

In 2022, RTE began capturing and storing an estimated annual output of 180,000 tons of CO₂ from its ethanol fermentation process, becoming the first facility permitted under state primacy to capture and store CO₂ in a Class VI well.

The total cost of this portion of the project is estimated at \$30 million.

RTE had originally counted on recouping this investment through the various revenue streams available for CCS, such as LCFS credits for low-carbon ethanol.

However, as RTE began injecting CO₂ into the Broom Creek formation, LCFS credit values had fallen significantly since the early days of planning. Moreover, the permitting time to generate credits was almost two years from the start of injection, which raised the threat of having a stranded asset for two years without the required revenues to be profitable.

RTE was determined to keep the project going despite this setback, and it began working with EcoEngineers (Eco) to educate its team on the nuances of all federal, state, and voluntary programs that incentivize BECCS.

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Through this process, it became clear to the RTE team that incentives available through the VCMs would be critical to the success of the project, and with Eco's help, pivoted to a new strategy.

The new strategy involved launching two parallel pathways:

1. To continue with the original goal of modeling and applying for low carbon fuel program pathways;
2. To diversify into VCM to provide further market opportunities to support the build out of CCS projects in tandem with compliance objectives in state LCFS programs.

A VCM pathway would provide greater diversification of revenues, de-risking the overall investment and providing 'optionality' for RTE to choose between VCM credits and credits from regulated markets once approvals were received.

Solution

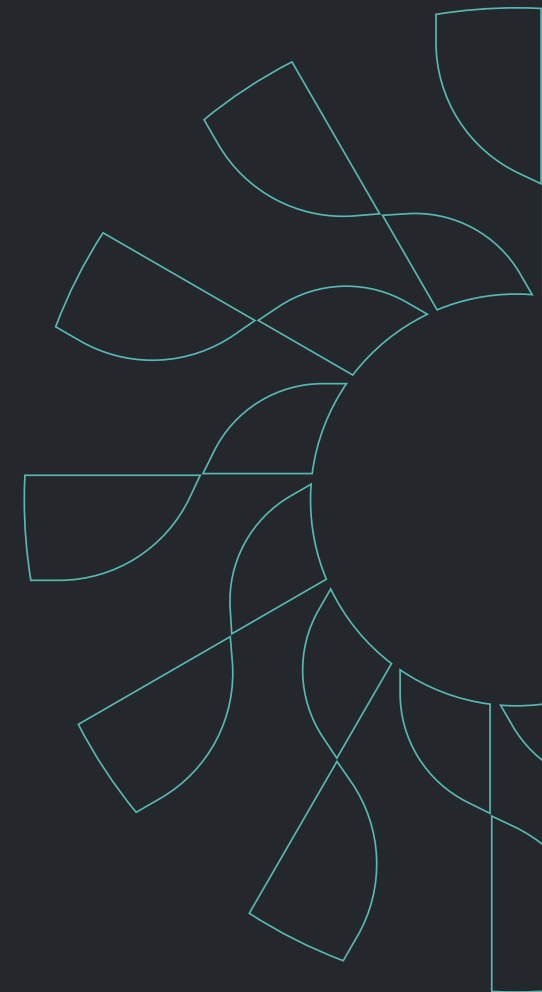
The first step towards entering the VCMs was to evaluate the potential to generate carbon dioxide removal (CDR) credits through a VCM feasibility study that scanned available registries for BECCS pathways and their specific requirements. The feasibility study also investigated the project's compliance with the additionality requirements of VCMs, which required RTE to establish that it would be economically unfeasible to continue with the CCS project without additional revenues from CDR credit sales.

The Eco team advised RTE on several issues unique to VCMs, including the selection of the registry, confirmation of project eligibility according to registry requirements, completing project design documents for project registration, quantifying total net removals by performing a customized Life-Cycle Analysis (LCA), along with compliance support for the data tracking required to develop fungible credits from the CO₂ sequestration operations. Eco also conducted an LCA to determine the CI of RTE's low-carbon ethanol with the inclusion of CCS equipment along with the sale of carbon credits generated from separating the environmental attributes of the fuel.

As a result of this work, RTE successfully registered under the Puro.earth standard for its CORCs generated through BECCS from ethanol production in accordance with the Geologically Stored Carbon Methodology.

The CO₂ that RTE sequesters from the fermentation process at its ethanol plant will be available as CDR credits to help buyers of the credits achieve their long-term sustainability or net-zero targets.

The Puro.earth-issued CORCs will indicate 1,000-plus years of carbon sequestration, which provides the key environmental criteria of permanence and proof of additionality. For traceability and transparency, CORCs are listed in the International Carbon Reduction and Offset Alliance (ICROA)-endorsed, Puro Registry where their complete lifecycle is recorded, from issuance to retirement.



“We have not only achieved a groundbreaking milestone as one of the first bioenergy facilities with CCS but have also emerged as pioneers in bringing verified CDR credits to the market. This program strengthened our position in the ethanol industry and has set a new standard for sustainability and innovation, driving positive change and demonstrating the viability of proactive environmental stewardship within our industry.”

Jodi Johnson

Chief Executive Officer
Red Trail Energy

“Monetizing CDR credits in the voluntary markets can be an important complementary revenue stream for companies across industries to support decarbonization efforts. Our goal was to help set RTE up for success in the regulated markets while helping them break new ground in voluntary markets. This gives RTE a significant competitive advantage within the ethanol sector and serves as a new industry standard for others to follow.”

Shashi Menon

Chief Executive Officer
EcoEngineers

Business Results

In early 2024, RTE's North Dakota ethanol facility became the first bioenergy facility in the U.S. to bring third-party verified CDR credits to the voluntary carbon markets.

Through Puro.earth and with EcoEngineers guidance, RTE was able to register more than 150,000 CORCs from the first 14 months of CCS operation.²

Entering into the VCMs has provided RTE with significant value for their stranded first year of CO₂ sequestered, while granting near-term optionality and empowering RTE with a long-term lever to select the best possible market on an ongoing basis.

“Engineered carbon removal is in its infancy and there are a great many risks for project developers. The need for high-quality removals programs, such as RTE, is undisputed in the context of our overrun global carbon budgets and the imperative to reduce carbon emissions. The VCM serves in this case to provide producers optionality for markets and to reduce revenue risks through diversification, consequently making such projects investable in the first place.”

David LaGreca

Managing Director, VCM Services
EcoEngineers

²CORC Carbon Removal Indexes - Puro.earth

Outlook

RTE continues to advance its CCS efforts and optimize its return on investment in the CDR space, while Eco's role as a 'harbor pilot' guiding RTE through the waters of CDR credits continues to evolve. Having completed the first phase of registering RTE with Puro.earth to generate CORCs, Eco's role has pivoted to assisting RTE with its annual reporting under Puro.earth for CDR crediting. As a validated project entity under the Puro.earth standard, RTE is eligible for ongoing credit issuances for five years with the option to renew every five years going forward.

Eco also continues to advise RTE on the strict compliance standards and maintenance of eligibility under the multiple markets in which RTE intends to participate. The interplay of state LCFS programs and CORCs requires BECCS projects to actively manage the detailed compliance requirements of each program and avoid double counting between programs. Eco's team of carbon consultants continuously monitors both regulated bioenergy markets and voluntary CDR markets; by sitting at the intersection of policy, technology, and carbon markets, they can guide RTE and other BECCS projects across the narrow straits of project development and compliance to successful revenue generation.

According to the Intergovernmental Panel on Climate Change (IPCC), CO₂ removals need to reach 6-10 gigatonnes (Gt) per year by 2050 to avoid reaching the 1.5°C limit.³ The market for durable CDR credits is enormous and supply is woefully short.

RTE is positioned as a leader at the forefront of both the decarbonization of the ethanol industry and the burgeoning CDR revolution. Its resiliency in the face of market uncertainty and the ability to pivot its strategy mid-project is a model for other BECCS projects in North America and across the world to follow.

³<https://www.carbon-direct.com/insights/state-of-the-voluntary-carbon-market-2023>

About Red Trail Energy

Red Trail Energy, LLC (RTE), located near Richardton, North Dakota, is an investor group that has established a corn-based ethanol production facility. Operational since January 2007 with a \$99 million investment, RTE employs 47 staff with a \$4 million payroll. Initially a coal-fired plant, it switched to natural gas in 2016. Annually, RTE uses 21-23 million bushels of corn to produce 59-64 million gallons of ethanol, also generating significant amounts of dried distillers grain, modified-wetcake, and corn oil. With a complex spanning 100,000 square feet, the facility includes a range of structures for various production stages and has implemented cutting-edge processing technologies. RTE is overseen by a 7-member board and has been recognized for its economic and environmental impact in North Dakota, receiving accolades from the Central Stark Soil Conservation District. RTE's mission is to enhance economic outcomes by transforming local corn into ethanol and value-added products.

About EcoEngineers

EcoEngineers is a consulting, auditing, and advisory firm with an exclusive focus on the energy transition. From innovation to impact, Eco helps its clients navigate the disruption caused by carbon emissions and climate change. Eco helps organizations stay informed, measure emissions, make investment decisions, maintain compliance, and manage data through the lens of carbon accounting. Its team of engineers, scientists, auditors, consultants, and researchers live and work at the intersection of low-carbon fuel policy, innovative technologies, and the carbon marketplace. Eco was established in 2009 to steer low-carbon fuel producers through the complexities of emerging energy regulations in the United States. Today, Eco's global team is shaping the response to climate change by advising businesses across the energy transition.

For more information, please contact clientservices@ecoengineers.us.