March 15, 2023

MARKET WATCH

CO_2 by Rail - An Emerging Supply Chain for Industrial Decarbonization

PLG CONSULTING CONTRIBUTOR:

Robert Russell - Sr. Consultant & Project Manager

Rob is a seasoned Transportation executive with over 20 years of experience via Union Pacific, Progressive Rail, and OmniTRAX bringing his passion for and expertise in Rail Carload, Intermodal, and Transload solutions to our client organizations.

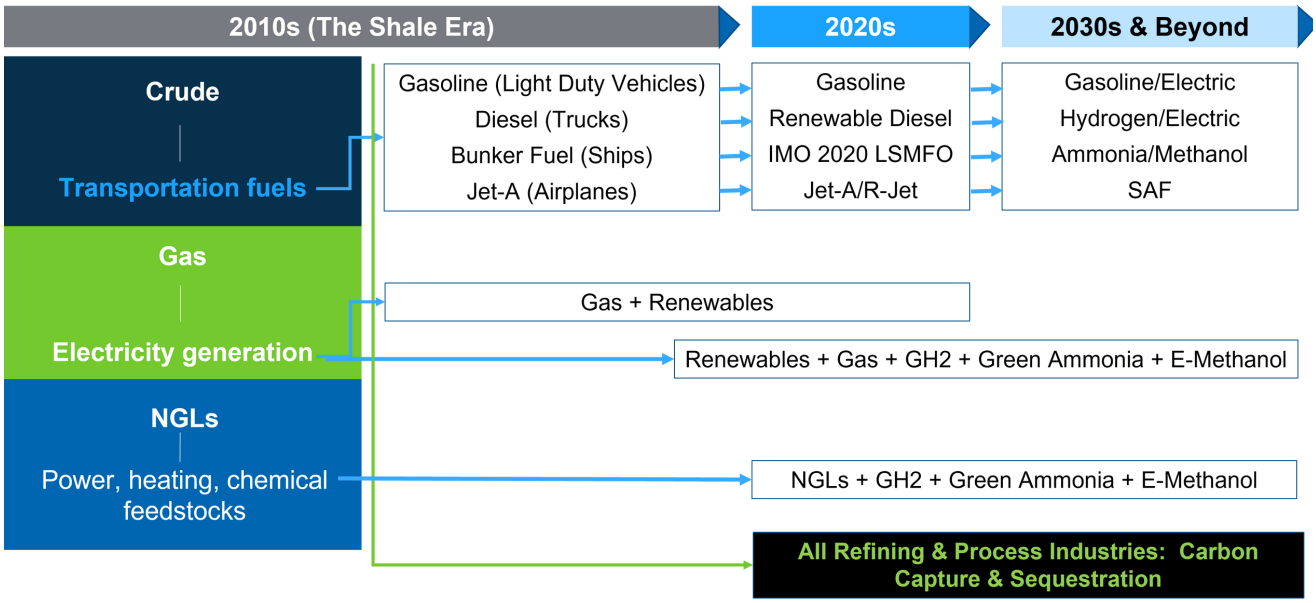
MARKET WATCH

CO_2 BY RAIL - AN EMERGING SUPPLY CHAIN FOR INDUSTRIAL DECARBONIZATION

Carbon Capture & Sequestration (CCS) initiatives in the US are creating emerging opportunities for emitters to economically reduce carbon emissions. To capture the benefits from these initiatives, new supply chains and logistics solutions to ship captured carbon to sequestration points are rapidly evolving. PLG Consulting works with clients to identify & deploy economically feasible CCS supply chain & logistics solutions.

Innovation in energy, government policies, and corporate commitments to ESG initiatives have brought carbon capture to the forefront as a critical component of the decarbonization equation. In 2019, The Energy Information Administration reported that the US produced approximately 5.13 billion metric tons of carbon dioxide emissions from energy consumption. This includes emissions from fossil fuels such as coal, oil, and natural gas for transportation and electricity generation, as well as emissions from industrial processes. Under the Paris Agreement, which the US rejoined in 2021, the country committed to reducing greenhouse gas emissions by 26-28% below 2005 levels by 2025. The Biden Administration has set a goal of achieving a carbon pollution-free power sector by 2035 and net-zero emissions economy-wide by 2050.

DECARBONIZATION REQUIRES MULTIPLE TRANSITIONAL FUELS, ALONG WITH CCS



$77/TN

THE INFLATION REDUCTION ACT (IRA) INCREASED THE TAX INCENTIVE FOR CARBON CAPTURE FROM UP TO $50/TON TO $77/TON IN 2022.

The US Inflation Reduction Act (IRA) has given a significant boost to CCS by expanding and extending the 45Q tax credit. The credit amount has almost doubled for CO_2 captured from power and industrial plants, and it has more than tripled for CO_2 captured from DAC (Direct Air Capture). Furthermore, the deadline to qualify for the credit has been extended by seven years to 2033. In addition to this, the Infrastructure Investment and Jobs Act will provide approximately $12 billion for the CCS value chain over the next five years. Various policy mechanisms such as R&D funding, loans, and permitting support will also be provided.

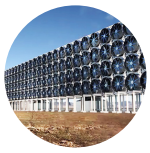
SOURCES: Energy Information Administration; International Energy Agency; PLG Consulting Analysis, March 2023

MARKET WATCH

CO_2 BY RAIL - AN EMERGING SUPPLY CHAIN FOR INDUSTRIAL DECARBONIZATION

WHAT IS CO_2 CAPTURE & SEQUESTRATION?

Carbon capture is a process that involves capturing carbon dioxide (CO_2) emissions from industrial processes and power generation and storing them safely underground or using them for other purposes. The carbon capture process typically involves three main steps:



CAPTURE

Capturing CO_2 emissions - from sources such as transportation, industrial & manufacturing processes, agriculture, construction, and power generation - creates a 'BLUE' variation of products from energy-intensive processes using natural gas. Today, global CO_2 capture comes from 35 facilities and captures 45MtCO_2 annually. The development has been slow but the IEA forecasts that by 2030 over 1200MtCO_2 will be captured via large-scale CO_2 projects. Innovation in new carbon capture technologies is increasing market participation and its cost-effectiveness.

TRANSPORTATION

Compressed CO_2 (liquid-state) is transported via pipeline, ship, truck, or railcar to a storage site or utilization facility. The most economical way to transport CO_2 depends on the distance to be covered, the volume of CO_2 to be transported, and the available infrastructure. CO_2 pipelines transport large volumes of CO_2 over short or long distances economically and safely with minimal loss or leakage. When pipelines are not available, ships, trucks and railcars are viable methods, but are generally more expensive.

STORAGE OR UTILIZATION

The final step is to store CO_2 safely underground in geological formations such as depleted oil and gas reservoirs or saline aquifers. Alternatively, the CO_2 can be used for other purposes, such as enhanced oil recovery or the production of chemicals and fuels. Injecting CO_2 into an oil reservoir enables the recovery of an additional 15% of oil. Investment in the carbon infrastructure including sequestration facilities is increasing planned projects through 2030. Additionally, new business models - like the development of industrial clusters (i.e., hydrogen hubs) - are driving demand for shared CO_2 transportation and storage.

CO_2 BY RAIL - AN EMERGING SUPPLY CHAIN

The impact of the Inflation Reduction Act's tax incentives has brought an emerging supply chain - CO_2 by rail - to the forefront providing the opportunity for companies to create profitable business models. Ethanol producers, manufacturers, industrial clusters including clean hydrogen hubs, and bioenergy companies are now considering rail as an efficient and cost-effective way to transport CO_2 to existing pipeline infrastructure or to storage facilities.

- Ethanol refineries in the American Midwest emit 43 million metric tons of carbon dioxide annually but are currently located far from existing CO_2 pipelines and mostly don't sit atop geological formations suitable for storing CO_2. Yet, ethanol production generates a high-purity CO_2 that lends itself to carbon capture projects.
- CO_2 railcars are designed to withstand high pressure and are typically made of thick steel. Insulated railcars help maintain CO_2 temperature limiting venting or evaporation. Time from load to unload is of the essence. Interestingly, venting CO_2 from a railcar has no negative environmental effect.
- Several companies are already exploring the potential for CO_2 capture and transport by rail in the US, particularly in the Midwest region, utilizing PLG Consulting's logistics competency for CO_2 capture business case modeling.

CO_2 Capture Business Models for:

- Ethanol Producers
- Hydrogen Companies
- Industrial Hubs
- Clean Energy Companies
- Bio-Energy / Agribusiness
- Carbon Capture Companies

In summary, these innovations in CO_2 capture are critical in helping reduce greenhouse gas emissions and combat climate change for a cleaner world. **Let's start the conversation.**

SOURCES: IEA; Princeton University; PLG Consulting Analysis, March 2023