# TECH BRIEF:
# Cowboy RNG 101

COWBOY CLEAN FUELS

## What is Cowboy RNG?

**Cowboy RNG is a form of natural gas produced through microbial processes that take place deep underground in geologic formations.** Like other forms of natural gas, Cowboy RNG can be transported through pipelines to be used in everything from power plants to plastics to fertilizer to pharmaceuticals. But unlike other forms of natural gas, Cowboy RNG does not contribute to climate change when it is combusted – in fact, the combustion of Cowboy RNG reduces the amount of climate change-inducing carbon dioxide ($CO_2$) in the atmosphere. Also, unlike conventional forms of natural gas, it is renewable so we will never run out of it.

## What is Natural Gas?

Natural gas is a gaseous hydrocarbon consisting primarily of methane that forms through a complex process that is hundreds of millions of years in the making, beginning with photosynthetic organisms such as plants. These organisms capture and store $CO_2$ and solar energy in the chemical bonds of organic molecules within the plant, including cellulose, hemicellulose, sugars and starches. When plants die, some of the organic plant matter accumulates in sedimentary environments like river deltas and ocean floors. Over geological timescales, sediment layers bury these remains, subjecting them to increasing heat and pressure. As the temperature and pressure rise, the organic matter slowly undergoes a series of transformations, eventually resulting in the production of methane and other hydrocarbons. **When methane is formed deep in the ground, underneath impermeable layers of rock, it can take the form of large, concentrated deposits which can be tapped to produce "Natural Gas" to the surface.** Unfortunately, when this natural gas is burned the carbon that was removed from the atmosphere through plant photosynthesis and trapped underground is released back into the atmosphere as carbon dioxide, contributing to global warming.

## What is Renewable Natural Gas?

**Renewable natural gas is essentially a biogas that has been upgraded for use in place of fossil natural gas.** Biogas, which consists primarily of methane ($CH_4$) and $CO_2$, can be produced as a result of the anaerobic decomposition of organic matter in which microorganisms break down biodegradable material in the absence of oxygen. In recent years, humans have devised ways to harness and control this process in engineered systems such as anaerobic digestors and landfills. Unfortunately, these engineered systems are capital intensive and also have high operating costs, as the biogas they produce must be upgraded by removing unwanted components like $CO_2$ and hydrogen sulfide to create RNG suitable for injection into natural gas pipelines or used as a vehicle fuel. Because it captures methane that would otherwise be released back into the atmosphere anyway, RNG is considered to be better for the environment than conventional natural gas.

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## How is Cowboy RNG Produced?

Cowboy Clean Fuels' approach to producing RNG uniquely blends principles from both conventional natural gas and traditional RNG methods. For instance, similar to the ancient processes that generates conventional natural gas, Cowboy RNG is produced underground – but on a human, rather than geologic, timescales. Instead of waiting millions of years for buried organic matter to transform into natural gas through time, heat and pressure, Cowboy RNG uses renewable organic materials, such as sugar beet molasses, which are injected directly into underground coal seams. There they serve as a food source for the indigenous microbial populations that inhabit these reservoirs. In this process, the coal seams function as "geobioreactors", swiftly decomposing the organic feedstock into methane and $CO_2$. **The coal's natural affinity for $CO_2$ molecules over $CH_4$ molecules ensures that the carbon dioxide is preferentially adsorbed onto the coal surface, effectively sequestering it deep underground, while the methane is free to be produced to the surface.**

This natural affinity allows the coal to function effectively as a $CO_2$ scrubber, upgrading the methane to a pipeline-grade "carbon-negative" form of RNG without incurring additional capital or operating costs. Since much of the necessary infrastructure can be sourced by repurposing existing natural gas facilities, such as coalbed methane (CBM) wells, Cowboy RNG requires minimal capital investment. Unlike traditional RNG, Cowboy RNG not only reduces carbon emissions but also delivers an effective climate solution by permanently sequestering carbon dioxide underground. **This dual benefit makes Cowboy RNG a more environmentally friendly option and a superior choice for carbon dioxide removal (CDR) compared to other forms of RNG.**

## What is the Impact of Cowboy RNG?

Cowboy RNG represents a transformative energy solution and climate strategy, redefining coal reservoirs from mere sources of non-renewable fossil energy into dynamic geobiological ecosystems with substantial environmental benefits. By harnessing the capacity of these reservoirs for long-term carbon storage, **Cowboy has reimagined coal's role in the energy economy of the future, enhancing its value as a crucial resource in the fight against climate change and in meeting future sustainable energy needs.**