January 7, 2022

California Air Resources Board
Industrial Strategies Division
1001 I Street
Sacramento, CA 95814

To: California Air Resources Board Staff

RE: Low Carbon Fuel Standard ("LCFS") – Public Workshop: Potential Future Changes to the LCFS Program

Recover Inc. appreciates the opportunity to provide comments on the potential future changes to the LCFS Program. We strongly support the LCFS Program's mission to help California achieve its greenhouse gas ("GHG") reduction goals by reducing the carbon intensity of fuels.

INTRODUCTION

California is a leader in reducing carbon emissions and decreasing dependence on oil and natural gas. The LCFS Program has been instrumental in decreasing the carbon intensity of California's transportation fuels and other successful California programs are leading the transition away from oil and natural gas. Oil and natural gas, unfortunately, remain the primary energy consumed by transportation, buildings, and manufacturing, in particular for emerging economies where fossil fuel consumption has been increasingly supplied by the United States. To help reduce overall GHG emissions, there is a need to account for emissions from oil and natural gas extraction waste in order to decrease carbon emissions from transportation fuels.

Oil and natural gas waste consists of drilling waste, tank bottoms, and oil spills/contaminated soils, which are predominately sent to Class II landfills in California and across the United States that are uncovered and do not have methane capture systems. These hydrocarbon waste streams biodegrade rapidly, resulting in up to 18 million metric tonnes of GHG emissions being released into the atmosphere annually in the form of methane and carbon dioxide.

While GHG emissions are a global problem, disadvantaged communities are particularly susceptible to the health risks associated with oil and natural gas waste, given Class II landfills and active oil and natural gas development areas are often located within these communities. In addition to daily exposure to airborne contaminants from the oil and natural gas waste in the uncovered Class II landfills, there is risk of the waste leaking into the environment, contaminating soils and groundwater supplies.

Recover developed a leading technology to recover and recycle oil and natural gas waste, significantly reducing GHG emissions and the carbon intensity of transportation fuel. Founded over fifteen years ago, Recover employs a solvent extraction technology that was adapted from numerous other applications (for example, food grade oils) and tailored to process oil and natural gas waste. Recover currently operates its commercial demonstration facility in Alberta, Canada and has partnered with a large industrial waste company in North America to build waste-to-energy facilities directly on their Class II industrial landfills. To date, Recover has identified twenty expansion sites across the United States, including in California.

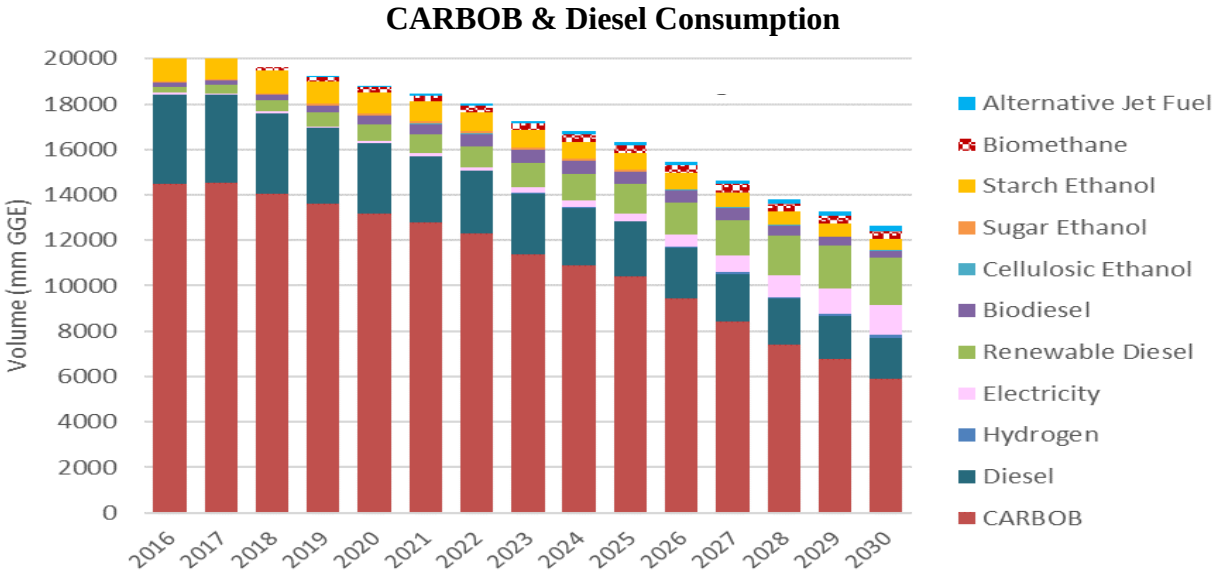
To further reduce the carbon intensity of transportation fuels and the potential for harmful contaminants released into the local environment, Recover respectfully requests changes to the LCFS Program to recognize the avoided emissions from recovering and recycling oil and natural gas waste. This will help accelerate the deployment of these waste-to-energy facilities in California and across the United States and will significantly reduce GHG emissions within transportation fuels, as well as provide other environmental and health benefits within disadvantaged communities. This could be accomplished by a two-step process:

1. Update the Oil Production Greenhouse Gas Emissions Estimator ("OPGEE") model to recognize the GHG emissions from these oil and natural gas waste streams, which would provide additional obligations credits for the fossil fuel industry; and

2. Create a new method or project type within the Innovative Crude or Refinery Investment Credit programs to help facilitate these GHG emissions reductions.

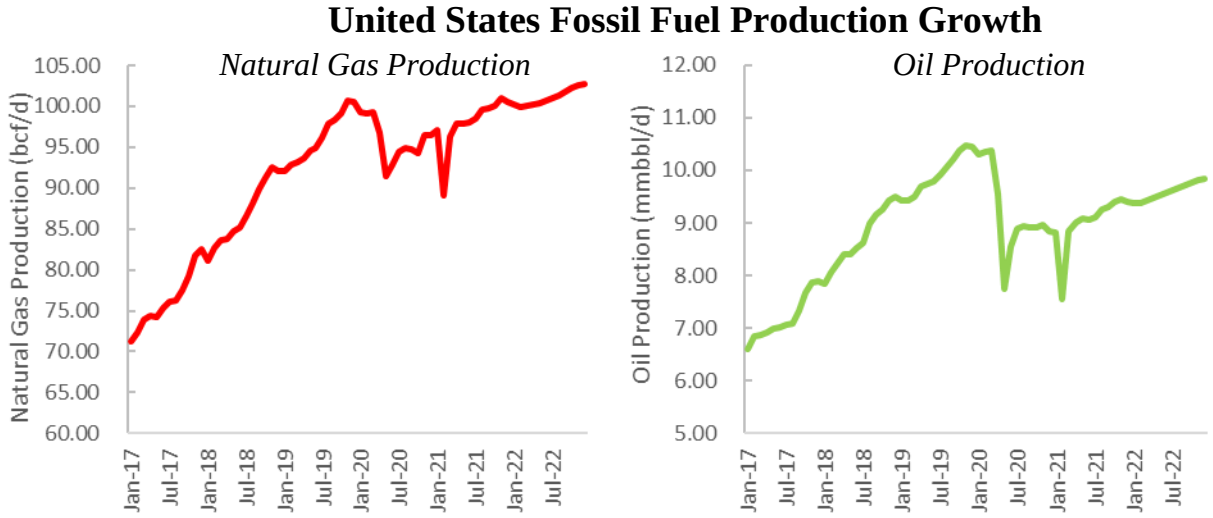
BACKGROUND

The LCFS Program has been instrumental in decreasing the carbon intensity of California's transportation fuels, and other successful California programs are leading the transition away from oil and natural gas. Despite the progress that has been made to transition to sustainable forms of energy, CARBOB and diesel will remain a significant portion of the future energy mix through 2030. As demonstrated in the chart below, even under progressive energy transition forecasts, it is estimated that CARBOB and diesel will still supply over 60% of California's transportation fuel demand in 2030.



Source: Life Cycle Associates, LLC - High Zero Emission Vehicles / Renewable Diesel Scenario

Beyond California, fossil fuel consumption has consistently risen over the past five years. To meet that demand, the oil and natural gas industry within the United States has been one of the key suppliers. Domestic energy security policy and fracking technology has allowed the United States to increase production of oil and natural gas. Furthermore, many energy economists are expecting that oil and natural gas production in the United States will continue to rise for the foreseeable future; it just will not be consumed within North America. Increased oil and natural gas production means more oil and natural gas waste and more GHG emissions.

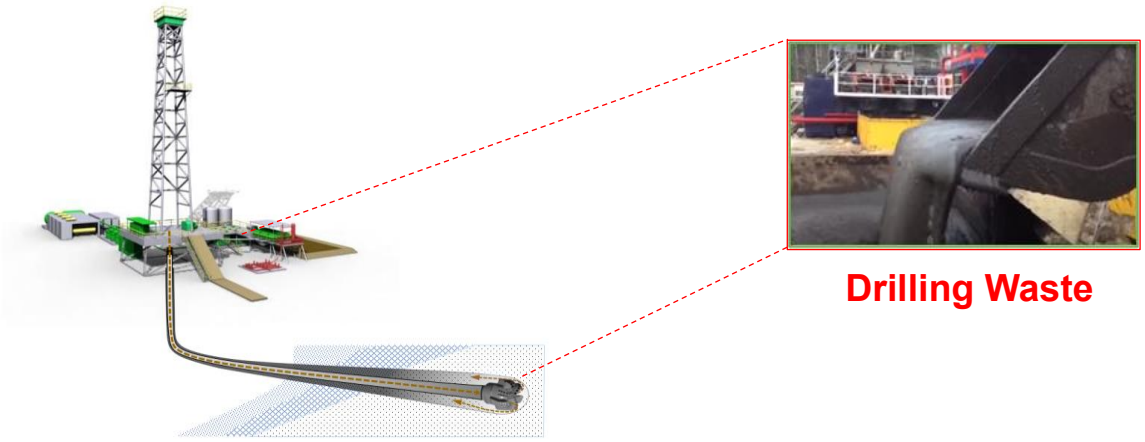


Source: Energy Information Agency "EIA"

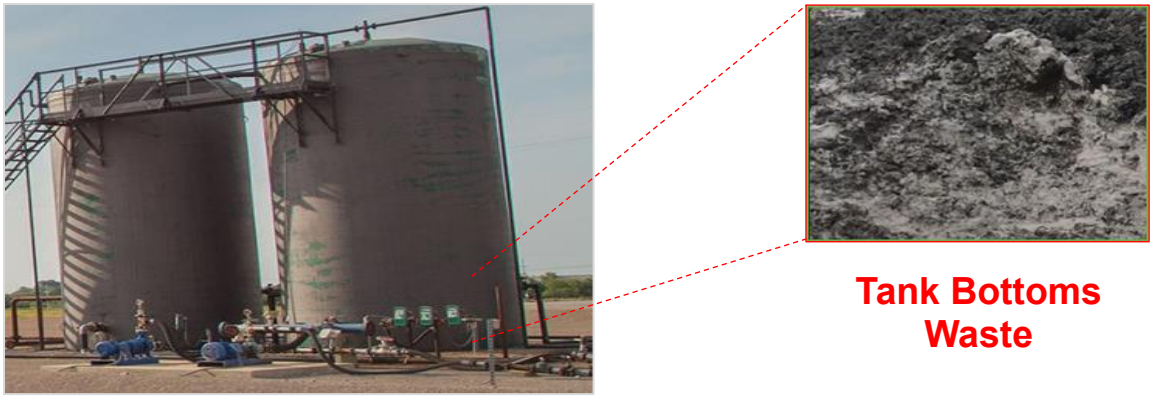
THE PROBLEM

During the life cycle of oil and natural gas development, there are three types of waste streams that are created that contain significant volumes of hydrocarbons. These waste streams include:

1. Drilling Waste – During the drilling of oil and natural gas wells, drilling waste is created as the rock particles from the ground are brought to surface and are coated in the drilling fluid. Today, we estimate that 90% of the wells that are drilled use an Oil Based Mud, which is created from diesel. In California, this waste stream is sent to Class II uncovered landfills for disposal.



2. Tank Bottoms – During the production cycle of the oil and natural gas wells, oil and other rock particles in the ground are brought to surface and eventually make their way into various tanks to undergo some form of density separation. Over time, the oily rock particles begin to overwhelm the tanks, at which point they need to be removed. In California, this waste stream is sent to Class II uncovered landfills for disposal.



3. Contaminated Soils – During the lifecycle of oil and natural gas development, there are spills and other releases of hydrocarbons into the local environment. Currently, the waste collected from spills in California is sent to Class II uncovered landfills for disposal. For example,

waste from the recent oil spill at Huntington Beach, shown below, was sent to an uncovered Class II landfill in California.

These harmful waste streams are the consequence of the production and consumption of oil and natural gas, and unfortunately these waste streams have no alternative end of life use. In California, all of these waste streams are sent to Class II uncovered landfills, where over time, the hydrocarbons will biodegrade resulting in unmitigated methane and carbon dioxide emissions entering the atmosphere.

IMPACT TO CALIFORNIA

Oil and natural gas operators in California pay service providers to transport and dispose of these waste streams and apply the same processes and techniques used throughout North America. The fluidic-hydrocarbon waste is brought to a stabilization area where it is mixed with a stabilizing material (sawdust or bulking soils) and then sent to Class II uncovered landfills for final disposition (pictured below). Once deposited, the hydrocarbon waste biodegrades and GHG emissions are released into the atmosphere. Until now, there has not been a commercially available option to recover and recycle these waste hydrocarbons to avoid these GHG emissions.

In addition to GHG emissions, there is a possibility that the hydrocarbon waste can escape, causing negative environmental impacts, such as ground water contamination. These contaminants present serious human health hazards, such as cancer, chemical pneumonitis, nephrotoxicity and neurological disorders.

Stabilization Area – Bakersfield, Ca. Ca.

Class II Landfill – Bakersfield, Ca.

Like other jurisdictions throughout the United States, it is common in California for oil and natural gas development activity to be situated near disadvantaged communities, with negative health hazards disproportionately harming vulnerable communities. The picture below shows a drilling rig operating adjacent to Ford City, California.

Drilling Rig within Community of Ford City

While the current disposal practices for these hydrocarbon waste streams are harmful to the environment, these methods represent "best in class" practices in North America. Oil and natural gas companies have been using these practices for decades due to a lack of viable technological options, costs, and the fact that regulations have not improved. As an independent company, Recover is not at all affiliated with any of the waste generators. Recover's sole focus is to clean up the waste that is created by others, while significantly reducing the GHG emissions that would otherwise be released into the atmosphere.

THE SOLUTION

Over the last fifteen years, Recover has developed a solvent extraction technology to recycle the previously described oil and natural gas waste streams and reduce the GHG emissions. This technology represents a complete and universal change to how oil and natural gas waste could be disposed, not just throughout North America, but globally.

Recover's solvent extraction technology was adapted from other commercial applications, such as food grade oils, and has been proven at a commercial scale. After the waste is processed, Recover produces negative carbon diesel and cleaned solids that are almost entirely void of hydrocarbons. Through Recover's process, more than 100% of the GHG emissions can be avoided that would have otherwise biodegraded and been released directly into the atmosphere from Class II uncovered landfills.

While Recover's technology is innovative in its application to oil and natural gas waste, n-Hexane solvent extraction is a proven technology that has been deployed on several other feedstocks. Within the LCFS Program, there are several existing LCFS pathways that use n-Hexane solvent

Feedstock	Solvent Extraction Technology (n-Hexane)	Output
Soybeans	✓	Diesel
Canola	✓	Diesel
Algae	✓	Diesel
Jatropha	✓	Diesel
Camelina	✓	Diesel
Oil Waste	✓	Diesel

Existing LCFS Pathways

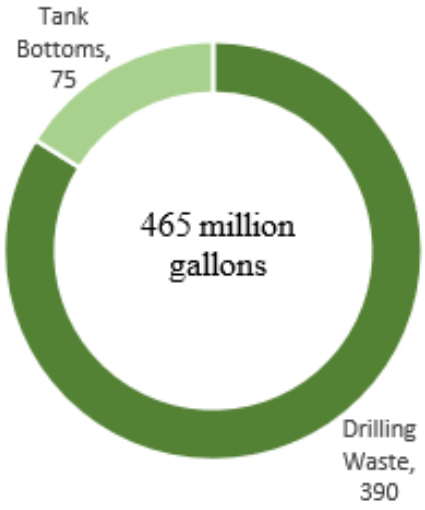
extraction technology on different feedstocks. These feedstocks include soybeans, canola, algae, jatropha and camelina.

Recover provides an opportunity to process oil and natural gas waste streams as new feedstocks that currently have no alternative uses, unlike other feedstocks which could be used as food production or for the protection of local habitat for wildlife, while minimizing GHG emissions from a significant quantum of waste.

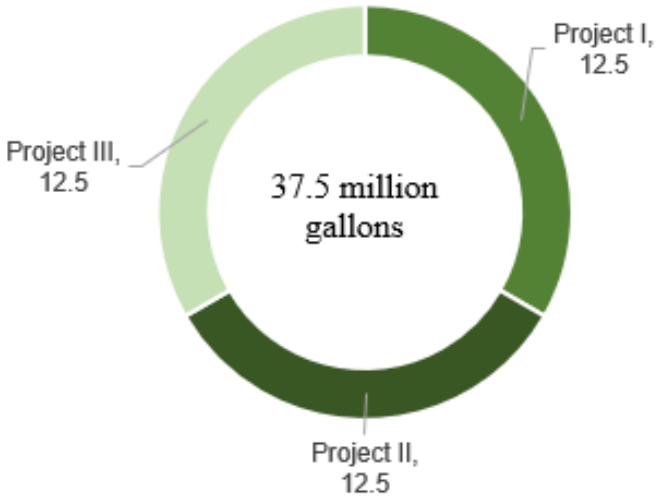
MARKET SIZE

Oil and natural gas waste streams are created in all regions where there is oil and natural gas activity. Based on Recover's estimates, there are more than twenty expansion locations where solvent extraction technology could be used in the United States, cumulatively capable of producing ~ 465 million gallons of carbon negative diesel per year. Of this amount, Recover estimates that oil and natural gas activity in California directly results in the disposal of ~ 4 – 9 million gallons of otherwise recoverable and recyclable diesel per year. In addition to the waste directly produced in California, the consumption of oil and natural gas in California that is generated in other jurisdictions throughout the United States, indirectly attributes to the disposal of ~ 45 – 70 million gallons of otherwise recoverable and recyclable diesel per year. In partnership

Annual Market Size



Three Recover Projects



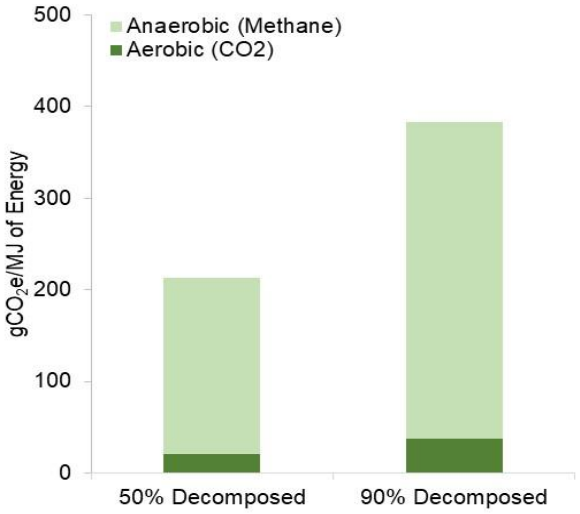
Source: Recover Estimate

with an industrial waste management company. Recover is advancing plans to construct three initial facilities to produce carbon negative diesel for the California market. The first three facilities will supply ~ 37.5 million gallons of negative carbon diesel annually. Recover also plans to expand into California and other locations throughout North America.

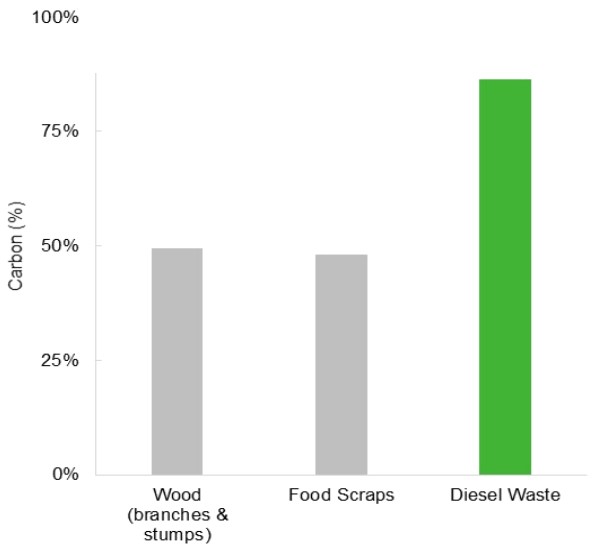
EMISSION REDUCTIONS

When hydrocarbons are exposed to the atmosphere, they undergo physical changes induced by aerobic and anaerobic biodegradation, whereby the carbon in the hydrocarbons is released into the atmosphere in the form of methane and carbon dioxide. Recover's technology recovers and recycles the carbon from the oil and natural gas waste, creating a new diesel product and in the process the emissions that would have resulted from biodegradation are avoided. Based on internal calculations, Recover estimates it can avoid between 200 gCO_2e to 380 gCO_2e of emissions for every MJ of energy that is created. To further quantify these estimates, Recover has commissioned an accredited lab to assess the biomethane potential of these waste streams.

Avoidance of Emissions



Carbon Percentage – Wet Basis



Source: Life Cycle Associates, LLC

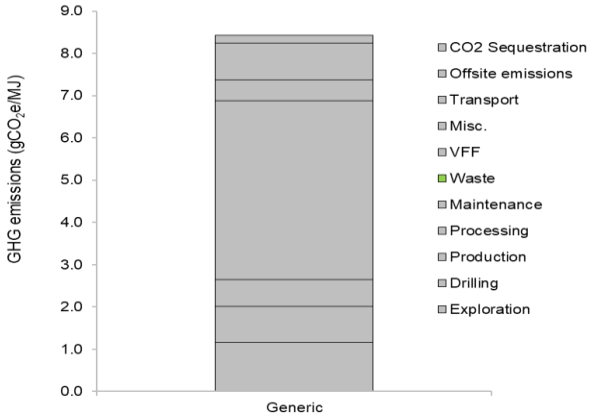
Within CARB's CA-GREET 3.0 model, many organic wastes are analyzed for the GHG emissions that would be created should they be disposed of in a landfill. These organic waste streams include food scraps and yard trimmings. On a relative basis, the oil and natural gas waste Recover recycles would have the highest carbon percentage, translating into the highest percentage of avoided GHG emissions. In addition, Class II landfills are not required to have methane capture systems; therefore, a greater percentage of the carbon in the oil and natural gas waste is released into the atmosphere in the form of methane emissions.

HOW TO FACILITATE CHANGE WITHIN INDUSTRY

Within the OPGEE model, GHG emissions related to oil and natural gas waste are not included because they are assumed to be small and occur sporadically over the life span of a producing well. Based on empirical evidence, the GHG emissions are significantly greater than many of the categories that the OPGEE model presently quantifies. This lack of quantification is partially responsible for why oil and natural gas companies do not report these GHG emissions and why

alternative technologies, such as solvent extraction that can reduce these GHG emissions, have not yet been made a priority to date.

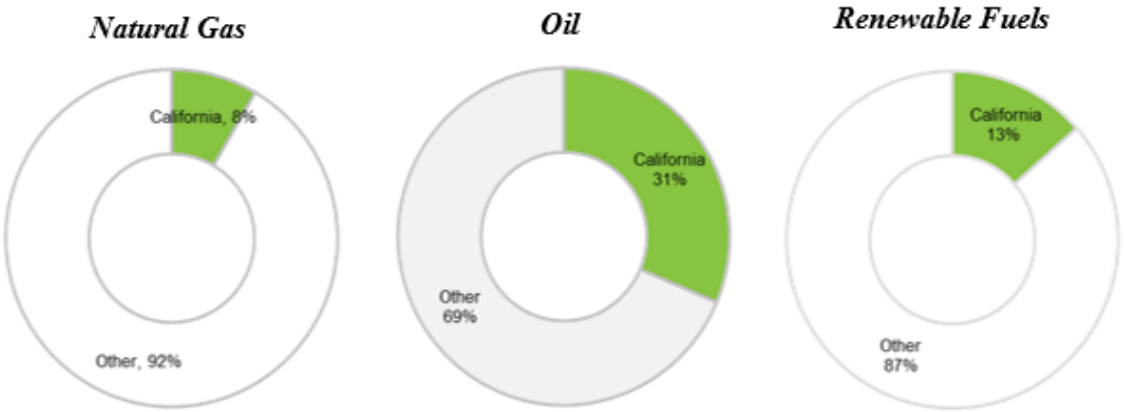
Contributions to GHG Emissions



If emissions from these waste streams were factored into CARB's OPGEE model, the overall carbon intensity for fossil fuels would increase. As a result, oil and natural gas companies would be obliged to purchase more offset credits to meet CARB's stated carbon intensity goals.

The majority of hydrocarbons consumed in California are produced outside the State. Based on EIA and California Energy Commission estimates, only 8% of the natural gas and 31% of the oil consumed in California are produced within the State. The balance of energy demand is supplied by imports from other areas where GHG emissions and other negative environmental impacts from oil and natural gas waste are unmitigated.

Origin of California's Energy Supply



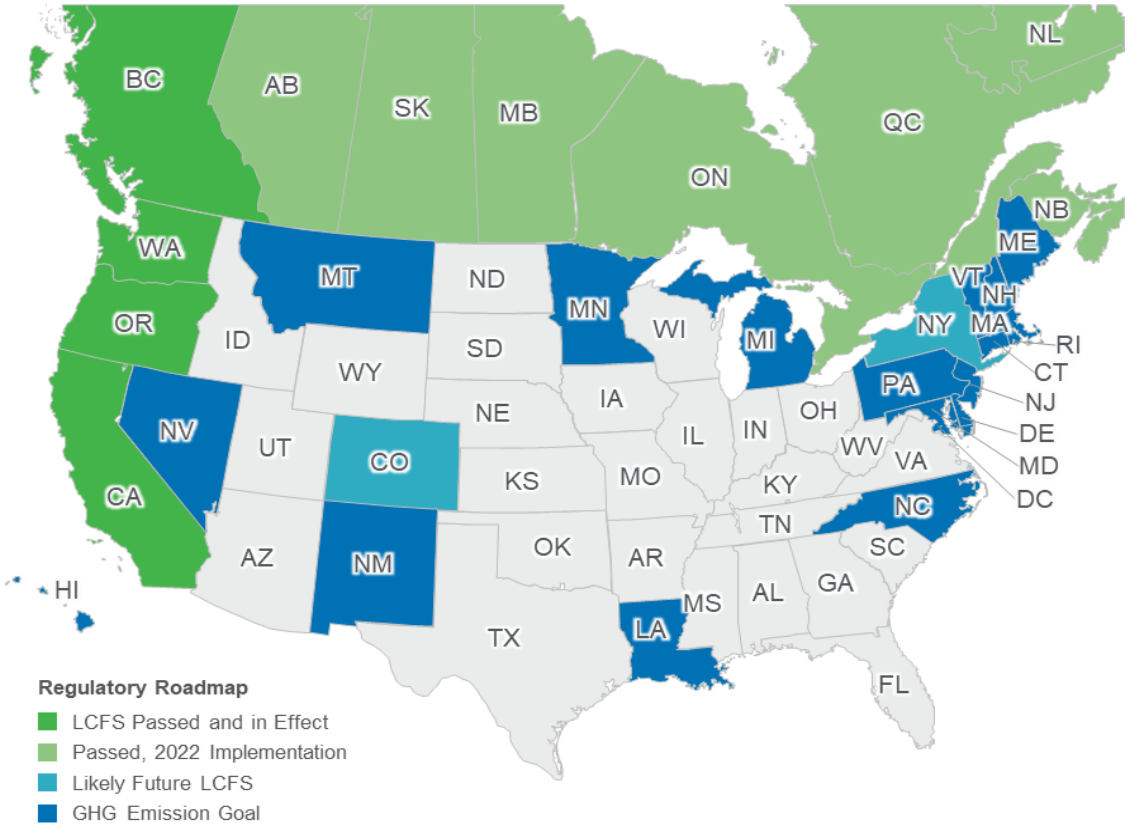
Source: CARB, EIA, California Energy Commission

With the success of the LCFS Program, a number of projects have been developed around the world to supply California with renewable fuels, whereas only 13% of these fuels are produced in California. Recover plans to build projects in California and other States to supply California with carbon negative diesel to help meet California's clean energy demands and GHG emissions reduction targets.

Over the past five years, there are several new LCFS Programs that have been, or are in the process of being, created across North America. These jurisdictions share a common desire with California, to lower the carbon intensity of their transportation fuels. They are looking to CARB to help sdevelop their own programs. By recognizing the avoided emissions from oil and natural gas waste, CARB can lead by example and further reduce GHG emissions across the United States and beyond.

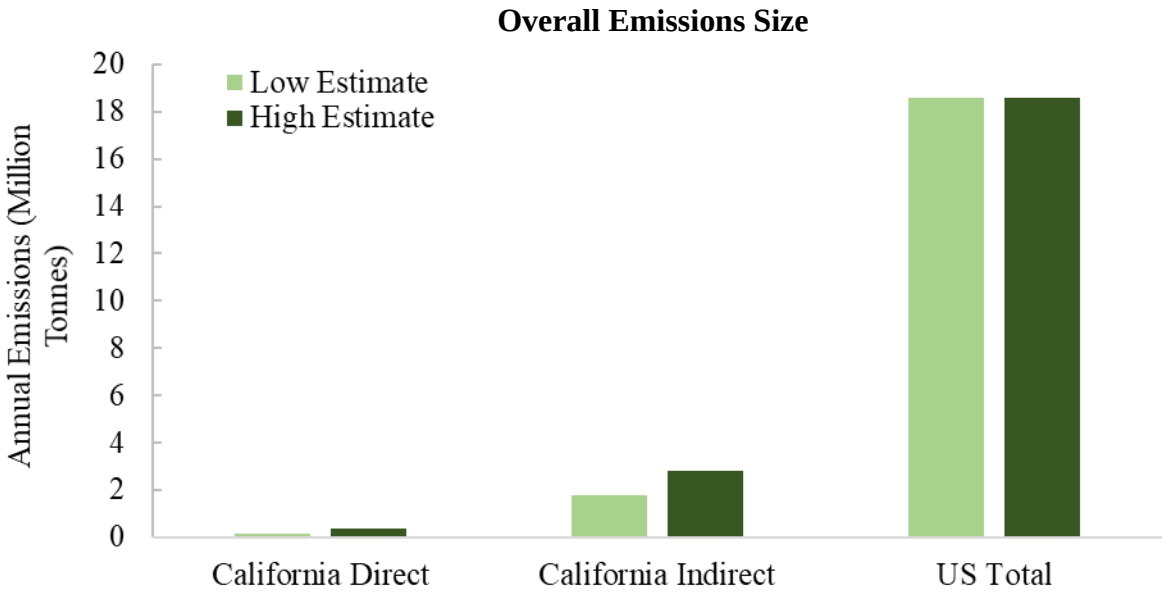
CALIFORNIA AND UNITED STATES EMISSIONS

LCFS Programs across North America



Source: Citi

When analyzing the emissions from the biodegradation of oil and natural gas waste, Recover estimates that California is directly contributing 0.2 – 0.4 million metric tonnes of GHG emissions into the atmosphere annually. In addition, California's demand for oil and natural gas is indirectly contributing 1.8 – 2.8 million tonnes of GHG emissions into the atmosphere annually. Beyond California, Recover estimates that the entire United States is emitting up to 18 million tonnes of GHG emissions into the atmosphere annually. These emissions could largely be avoided by recovering and recycling oil and natural gas waste.



Source: Recover and Life Cycle Associates, LLC

PROPOSED CHANGES TO THE LCFS PROGRAM

Recover greatly appreciates the opportunity to work with CARB during the LCFS amendment process. We respectfully request consideration of proposed changes, or other approaches, to include solvent extraction of hydrocarbons from oil and natural gas waste in the LCFS Program to drive deployment and achieve GHG emission reductions and other environmental and community benefits.

1. Oil and natural gas waste that is sent to Class II uncovered landfills biodegrades quickly and produces up to 18 million metric tonnes of harmful GHG emissions on an annual basis. There is also a likelihood that a portion of oil and natural gas waste escapes into the local environment, potentially contaminating water supplies and disproportionally affecting disadvantaged communities. Recover respectfully requests that oil and natural gas waste that is subject to a hydrocarbon extraction and recycling methods be recognized as avoided GHG emissions, similar to other waste streams; and

2. The benefits from avoiding harmful GHG emissions associated with oil and natural gas waste emitted from legally allowed procedures be recognized in the LCFS Program, through the creation of a new method or project type within the Innovative Crude or Refinery Investment Credit programs.

Thank you for your consideration of these, or other options, to include solvent extraction of hydrocarbons from oil and natural gas waste in the LCFS Program. We look forward to working together to reduce carbon emissions in transportation fuels and help avoid these exposures to sensitive receptors in vulnerable communities in California and beyond.

Kind regards,

Recover Inc.

Stanley Ross
President & CEO