Renewable natural gas

RNG for heavy-duty trucking

Clean Energy

2024 TRANSPORTATION INNOVATION FORUM

HOSTED BY PTI PAPER TRANSPORT

Agenda

RNG delivery process

RNG industry growth and infrastructure

RNG benefits

Emissions reporting

RNG end use opportunities

RNG “mass balance” delivery

Farm/Source
Organic waste is collected and taken to a digester.

Digester
The digester processes the waste and captures the biogas.

Upgrading
The biogas is purified into RNG and injected into the local pipeline.

CE stations
RNG is allocated via “mass balance” methodology (book-and-claim) to stations nationwide.

Filtered-out waste solids from a digester can be used as fertilizer and dry bedding for the farm.

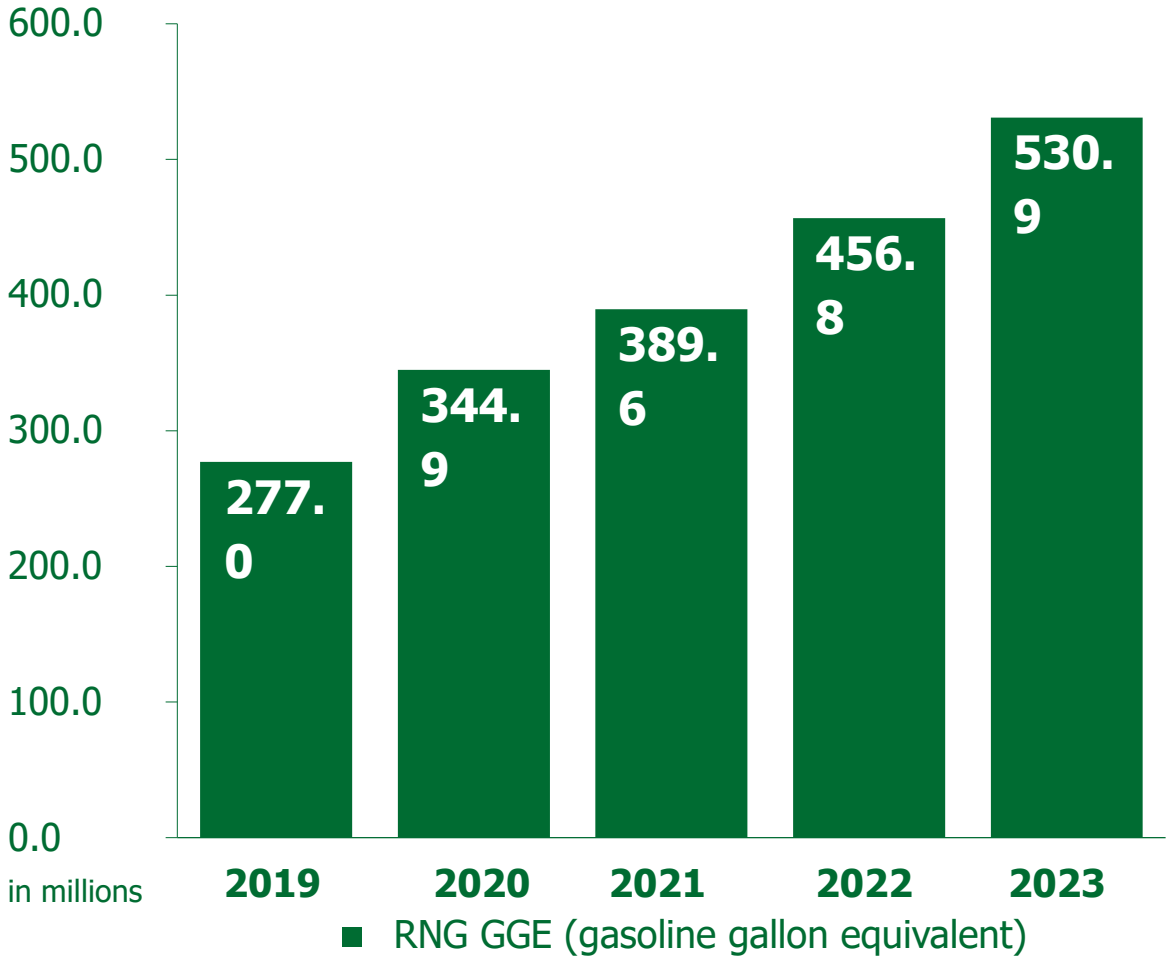
*RNG is derived from a naturally occurring biological process so is considered “**biogenic**” resulting in emissions reporting benefits*

RNG growth (2019-2023)

RNG use as a transportation fuel grew **16% over 2022** volumes, increasing **92%** over the last five years.

RNG offset a total of **6.96 million tons** of CO2e in 2023.

RNG made up **79%** of total natural gas vehicle fuel used (675mm GGE) in 2023.



Source: The Coalition for Renewable Natural Gas and The Transport Project

RNG production facilities and fueling stations

RNG production facilities and volume by feedstock

338
In operation

165
under construction

324
In development

5%
Food waste/SSO

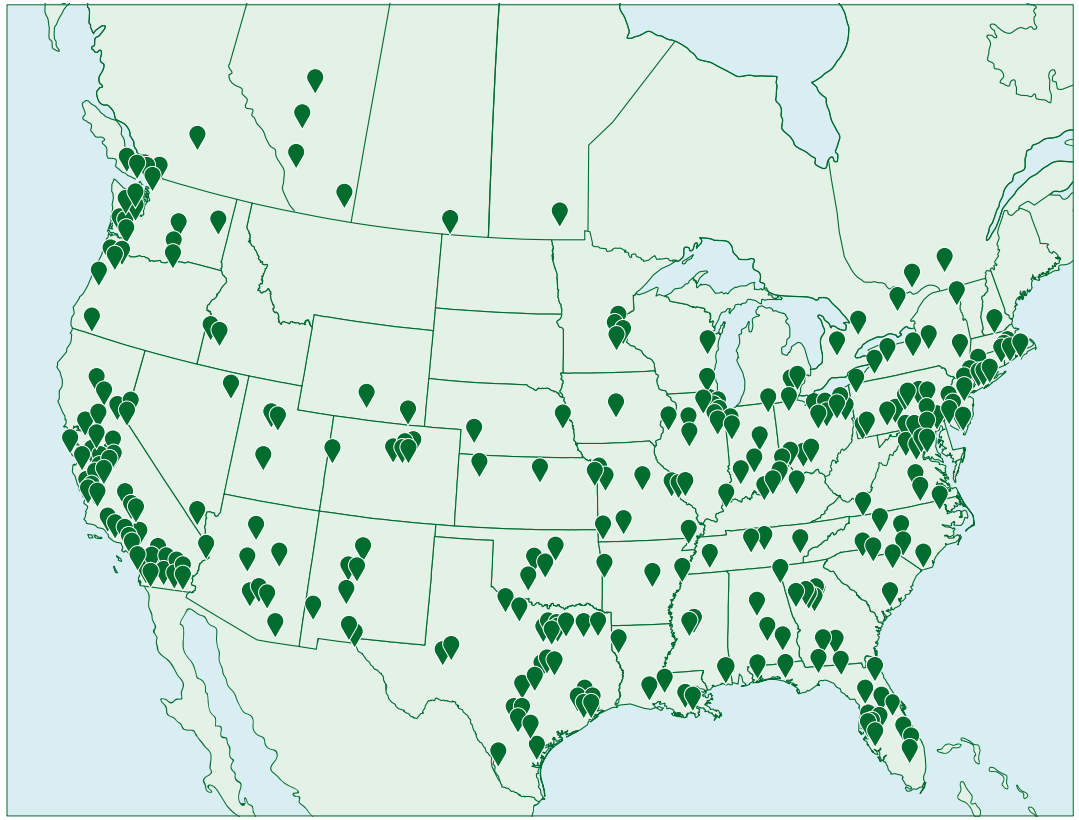
4%
Wastewaster

24%
AG waste

67%
MSW

Source: Clean Energy and The Coalition for Renewable Natural Gas

RNG fueling stations in North America



RNG benefits

Fleets can save up to **$2.00 per GGE** depending on location in U.S. by switching from diesel to RNG

Replaces diesel and fossil natural gas in heavy-duty vehicles.

Reduces local air pollution and emissions attributed to transportation.

Converts organic waste materials into a valuable "drop-in fuel" product.

Captures emissions before they can harm our environment.

Emissions reporting: GHG Protocol

Renewable natural gas

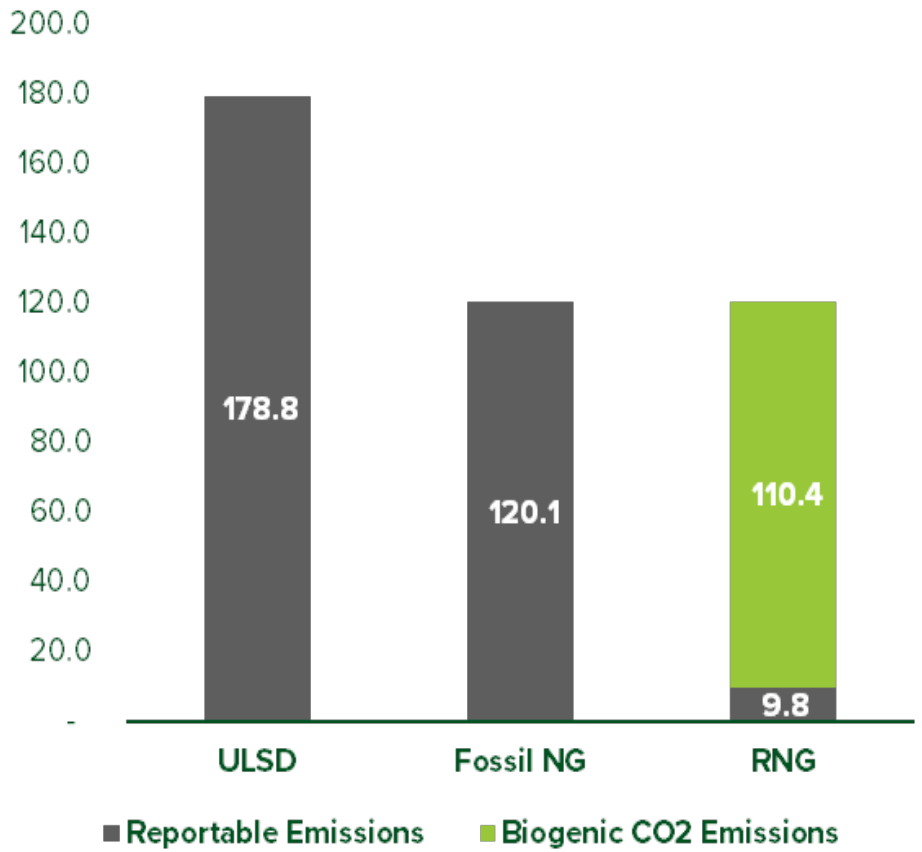
Because "biogenic" CO2 emissions are reported separately from tailpipe emissions, RNG reduces your Scope 1 or 3 emissions by 95%+ compared to diesel.

Tailpipe carbon intensity: gCO2e/MJ*

GHG	Diesel	Fossil NG	RNG
CH4	0.03	4.82	4.82
N2O	0.72	0.13	0.13
CO2	74.10	55.78	~~55.78~~
Total	**74.85**	**60.73**	**4.95**

**CI emissions based on CA GREET model*

Emissions reporting per truck (MT CO2e)*



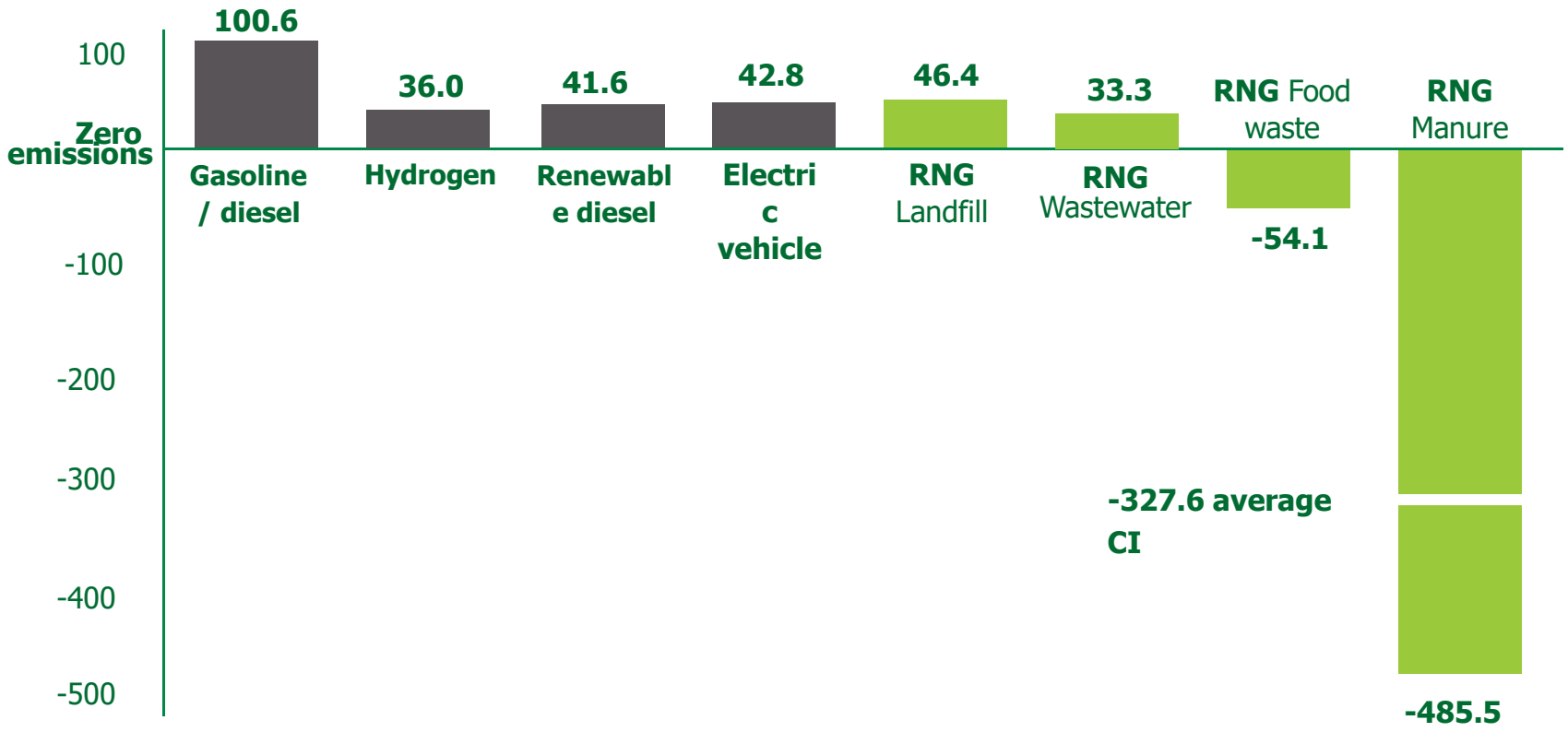
**Assumes a truck uses 15,000 gallons per year*

The CI advantage of RNG: LCFS programs

At –126.42, RNG (in CNG form) holds the lowest average CI of any clean fuel option on California's roadways today.

Note: Data from CARB LCFS Reporting Tool Quarterly Summaries (calculated weighted average)

Carbon intensity by fuel type (gCO2e per MJ)



Source: California Air Resources Board, Q4 2023 LCFS data, and certified pathways as of April 30, 2024

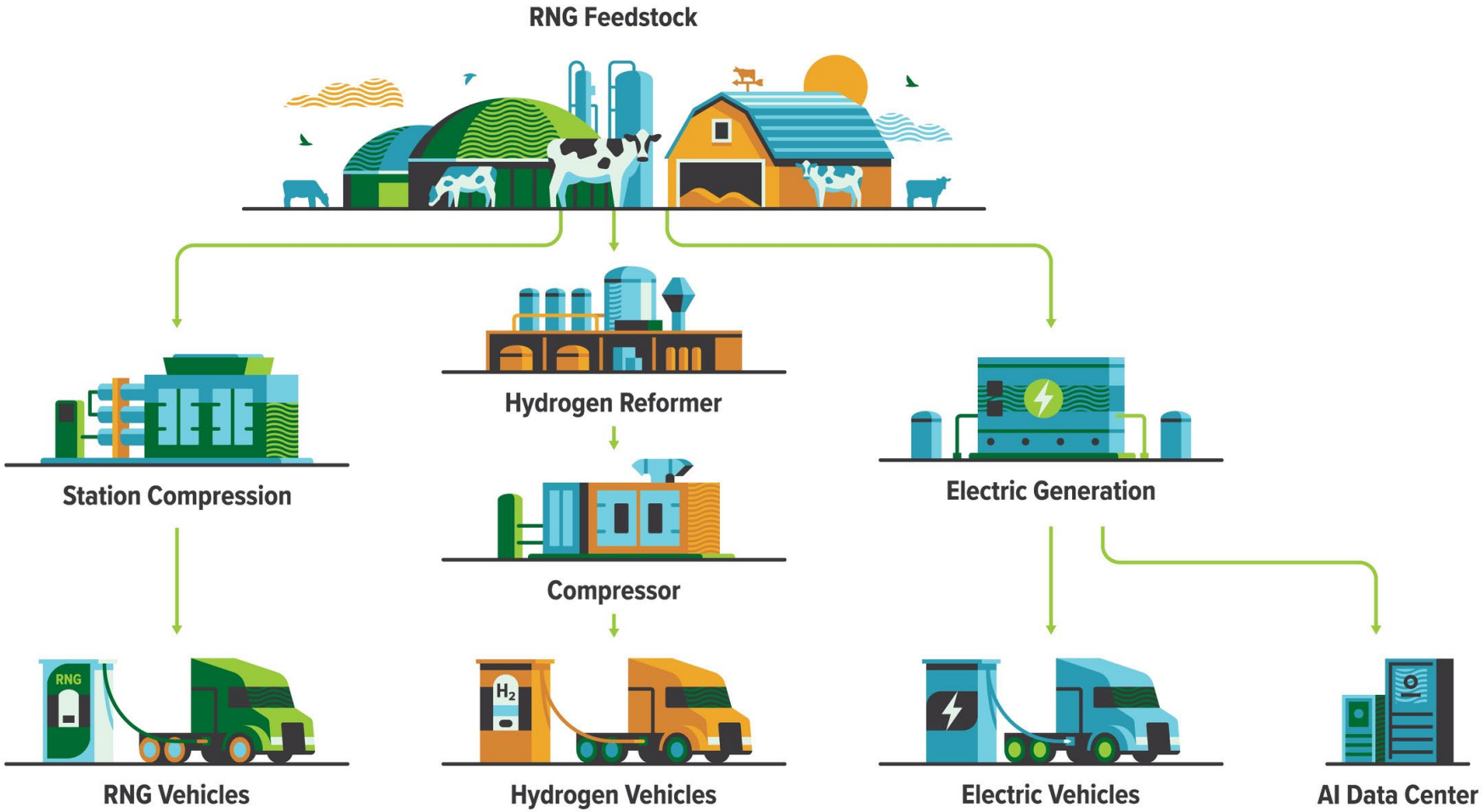
Connecting the “scope emissions” boundaries

A carrier’s Scope 1 fuel emissions are a shipper’s Scope 3 emissions.

Carriers using RNG can immediately claim a ~95% reduction in CO2 emissions reporting and can qualifying as negative CI operation in certain programs.

RNG is a tool for corporations trying to make a positive impact on the climate and meet internal sustainability goals.

A feedstock for any future



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Shifting carbon into reverse.

Learn more about RNG and how it can save you money while reducing your carbon footprint at

www.clearnenergyfuels.com
