

THE NITTY GRITTY: IMPLEMENTATION OF RENEWABLE FUELS PROCUREMENT

**VANGUARD
RENEWABLES®**



COMPANY HIGHLIGHTS

Pioneer in renewable energy space, developing and operating across the U.S.

- We are a climate impact business, decarbonizing multiple industries including food and beverage, natural gas, and agriculture
- Produce Vanguard RNG, a negative CI fuel
- Integrated nature-based solution, supporting multiple Sustainable Development Goals (SDGs)

Vanguard has a robust pipeline of 50+ projects with a ~15 Bcf capacity and in 2022 partnered with BlackRock

- National leader of anaerobic digestion in the U.S., 10-year operating history
- Strong track record of having 17 agricultural waste & food waste co-digestion facilities with an annual capacity of more than 4.5 Bcf RNG
- Large portion of pipeline is in permitting or late stages of planning

Fueled by innovation and engaging in multiple strategic partnerships

- Innovative partnership with AstraZeneca to maximize their technological resources to work on a twin model of our engineered project design
- Joint venture with Total Energies to develop 10 projects (2.5 Bcf+) over the next 12 months

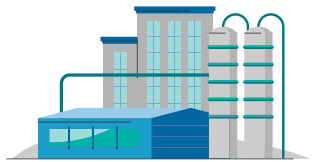


WE OFFER A CIRCULAR SOLUTION TO POWER YOUR PRODUCTION WITH YOUR FOOD WASTE

We collect your organic waste

We depackage and pre-process waste

We produce fertilizer and animal bedding for local farms in the process



Manufacturing

Organics receiving area
(Pre-processing)

Anaerobic
Digester

Fertilizer & Bedding

We convert organic waste and manure from local farms into renewable natural gas

A SOLUTION ACROSS 17 OPERATIONAL SITES



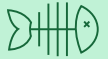
17

Operational projects across the US



1.9M

Tons food waste and manure recycled



50+

Food waste and manure anaerobic digestion projects in development



4.5

Bcf/yr RNG nameplate capacity



1.6M

Tons low-carbon fertilizer

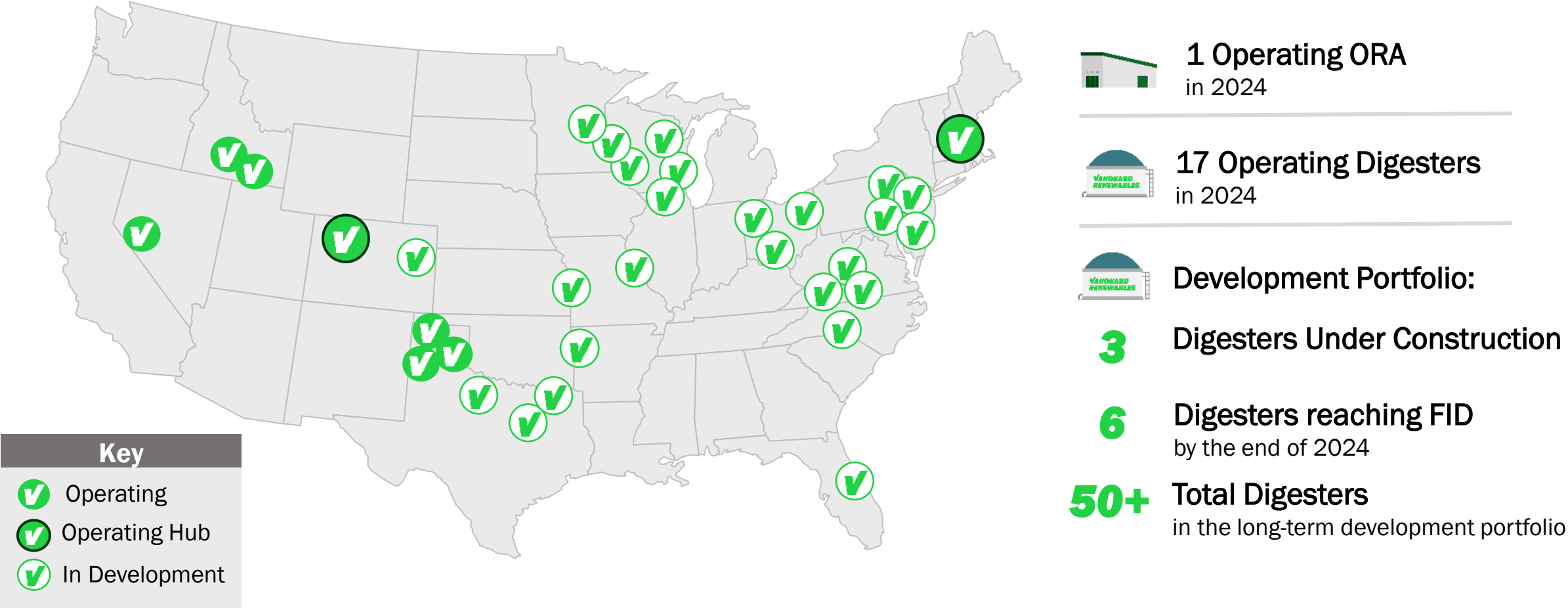
**VANGUARD
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WHERE WE ARE AND WHERE WE ARE GOING



WHERE WE ARE & WHERE WE ARE GOING

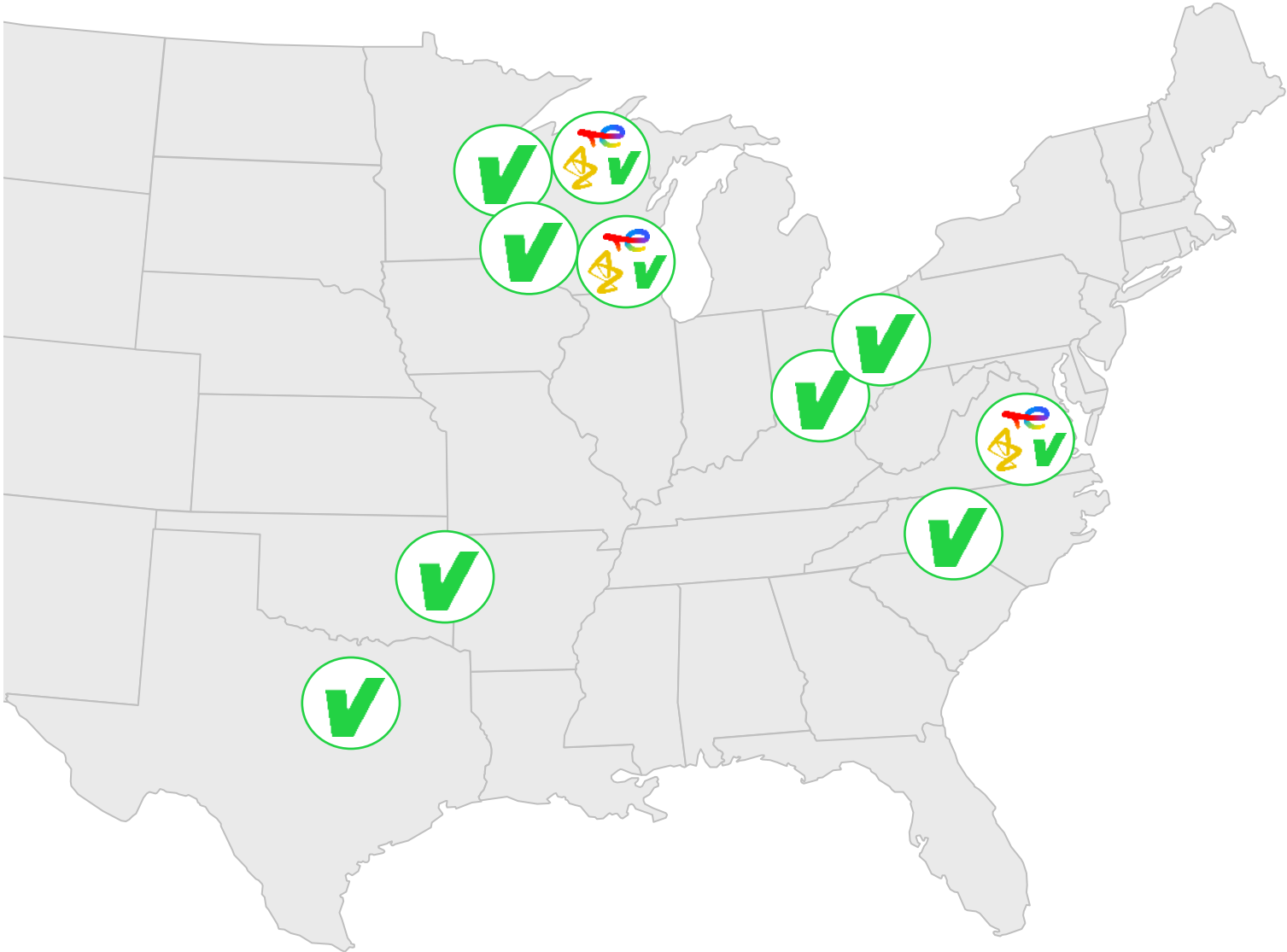
Founded in 2014, Vanguard Renewables is the leading renewable natural gas producer from anaerobic digestion in the U.S. We specialize in methane sequestration from manure and organic waste streams.



NEXT 10 PROJECTS IN DEVELOPMENT

Vanguard Renewables is working with TotalEnergies on a portfolio of projects and AstraZeneca is working as our offtake partner to decarbonize their U.S. facilities.

Key	
	TotalEnergies
	AstraZeneca
	In Development



PROJECTS IN DEVELOPMENT

- In our construction process, we build (1) lagoons, (2) digester tanks, and (3) organics receiving areas (ORA) on our organics projects to accept incoming food and beverage waste.

1



**VANGUARD
RENEWABLES**

3



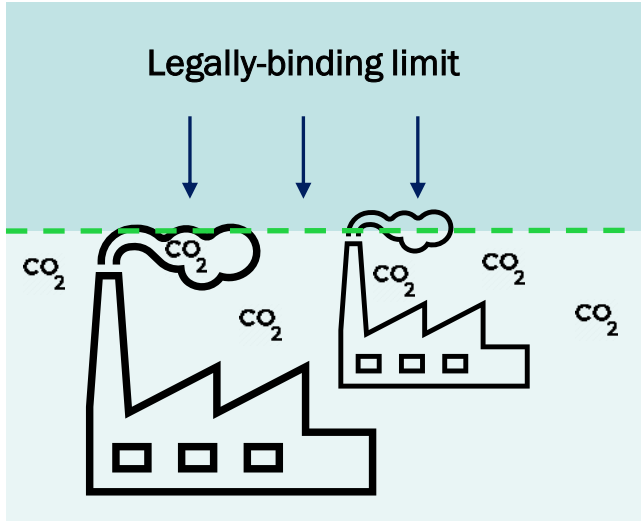
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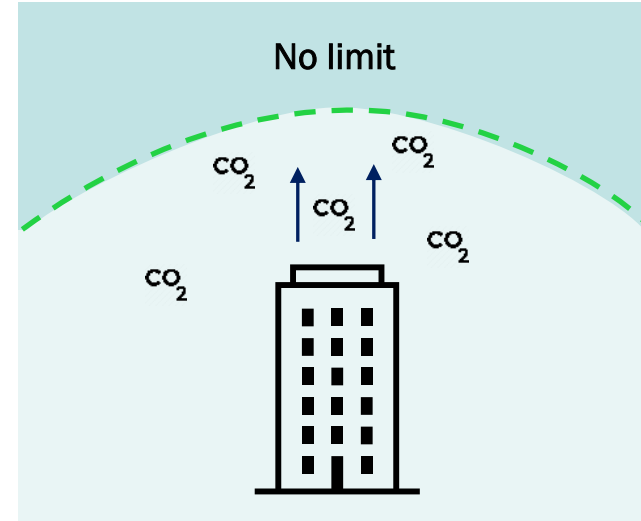
U.S. COMPLIANCE AND VOLUNTARY

MARKETS FOR VANGUARD RENEWABLES RNG

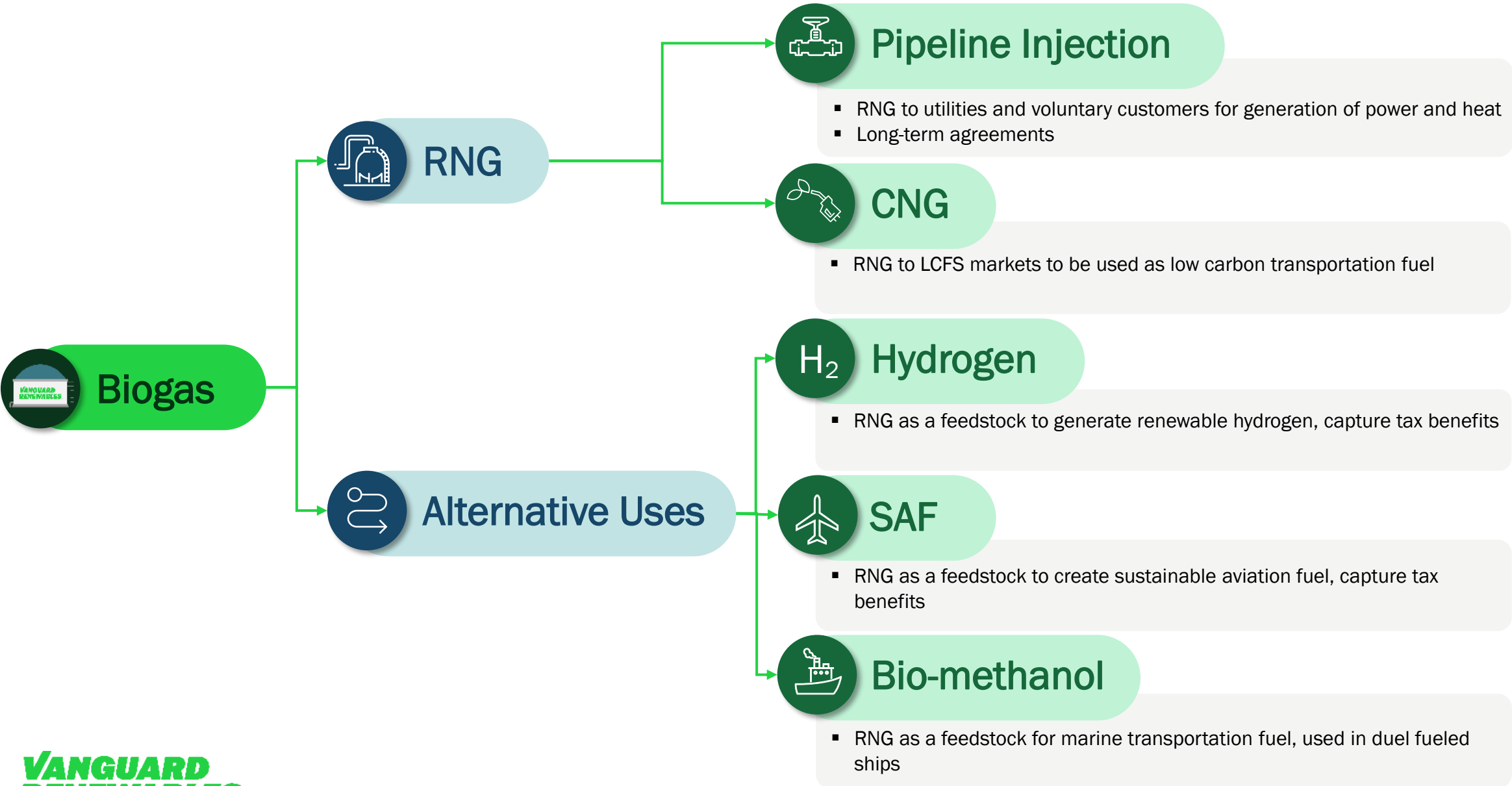
- Compliance Markets (Cap-and-trade)
 - Entities emitting GHGs above a certain threshold that are required by law to reduce their emissions and/or purchase credits
 - Ex: Airlines, Transportation in California



- Voluntary Markets
 - Entities that opt in to reduce their emissions and/or purchase credits
 - Ex: Corporations, Governments



COMMERCIAL PATHWAY: CURRENT AND FUTURE



VANGUARD RENEWABLES RNG FOR VOLUNTARY THERMAL USE

- Drop-in replacement fuel for conventional natural gas
 - No CapEx or phase out of long-term capital equipment
- Complementary with energy efficiency and electrification where applicable
 - Powerful decarbonization tool for hard to electrify processes
- Buying Vanguard RNG supports new-to-grid energy infrastructure, local farmers, regenerative agricultural practices and organic waste mitigation



ENVIRONMENTAL ATTRIBUTES OF RNG

Vanguard Renewables RNG is a zero-emission fuel

- Minting of environmental attributes sits directly above Vanguard's operating data and characterizes production facility, volume, carbon intensity and vintage
- Option to purchase "Bundled RNG"
 - Physical natural gas + environmental attribute
- Option to purchase environmental attribute only

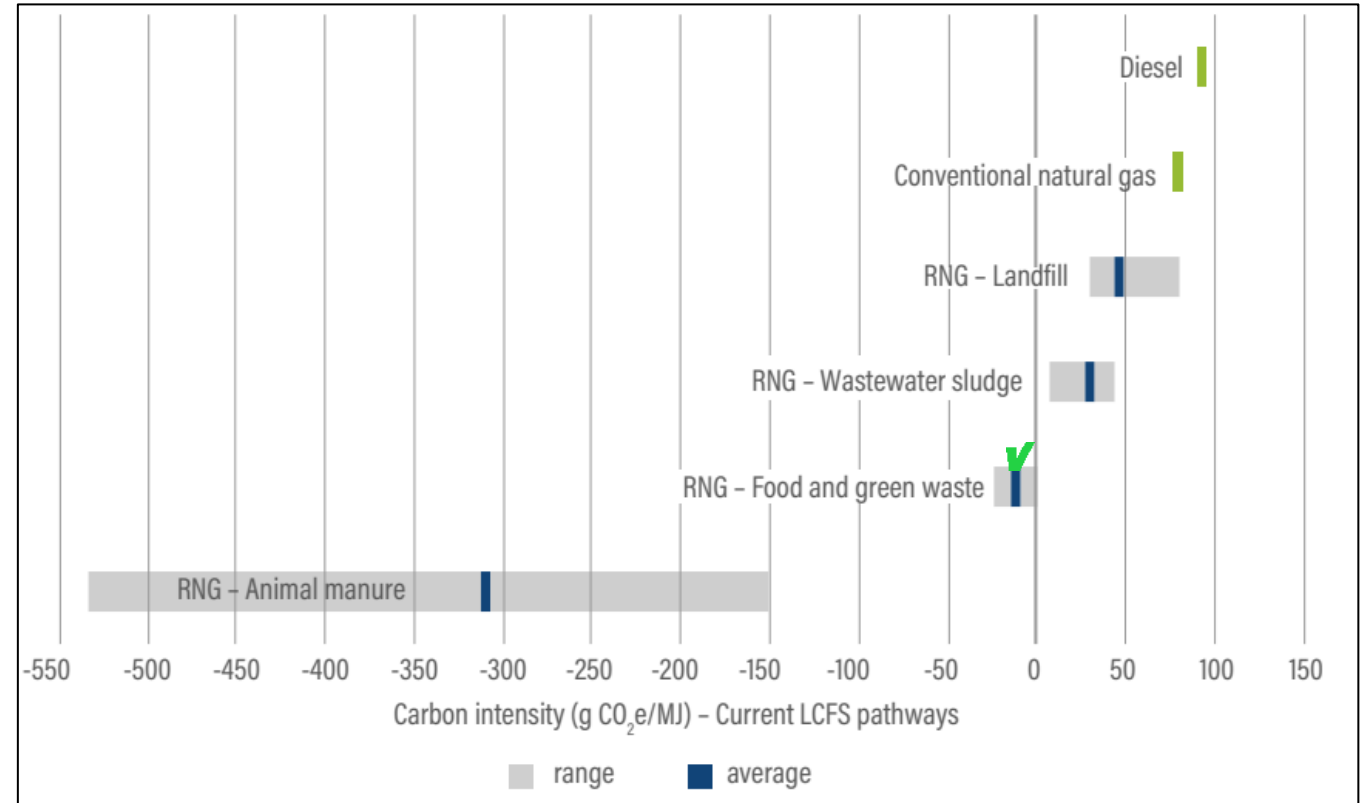
How it Works:

- Environmental attribute examples include:
 - Renewable Identification Numbers (RINs), California Low Carbon Fuel Standard (LCFS) credits, and Oregon Clean Fuel Program (CFP) credits
 - Voluntary carbon markets like Renewable Thermal Certificates (RTCs)
- Tracking, retirement, and/or the sale of environmental attributes are supported.
 - M-RETS
 - ISCC EU / Plus
 - Green-e

CARBON INTENSITY: WHERE VANGUARD'S RNG STANDS

- Vanguard's RNG is produced from co-digested food waste and dairy manure.
 - Typically holds a carbon intensity score approximately -50
 - Modified CA GREET Model
- Ongoing assessments for ISCC EU and GREET Modeling
- Maintaining projected range of 0 to -100 for co-digested organics projects
 - Template to evaluate development project specifics and understand indicative CI score

Carbon Intensities of Different RNG Production Pathways



Source: The Coalition for Renewable Natural Gas & Guidehouse. (2023). USING RNG TO MEET VOLUNTARY GHG TARGETS: A PRIMER FOR SUSTAINABILITY DIRECTORS [White Paper].

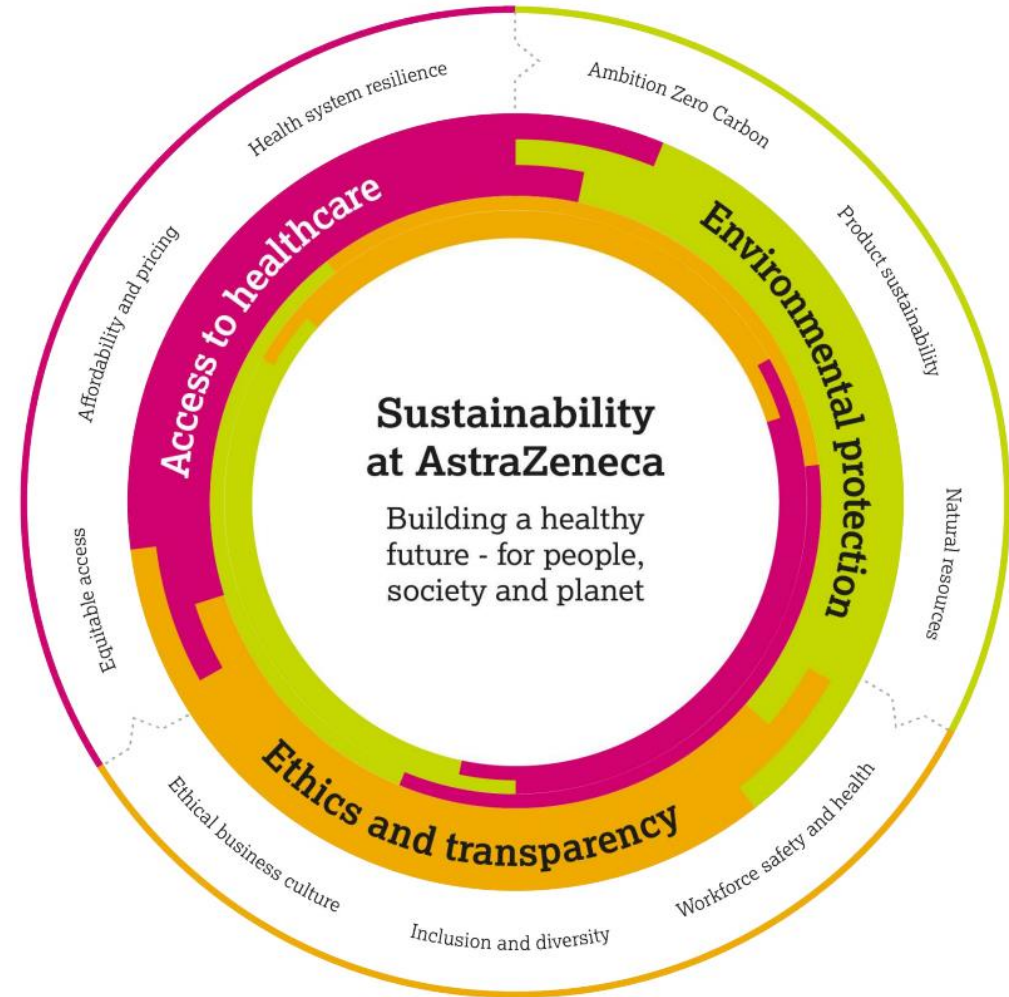
[RNG+Coalition+Draft+Report_Final_Updated.pdf \(squarespace.com\)](#)

Carbon intensity estimates provided by EcoEngineers 11/8/2018 utilizing the CA-GREET 3.0 model issued by the California Air and Resources Board (effective 1/4/2019).

PARTNERSHIPS

CASE STUDY: ASTRAZENECA

- June 2023 – transformative partnership with AstraZeneca
 - Long term RNG supply deal for 100% of anticipated natural gas usage after efficiency and electrification initiatives
- AstraZeneca is taking a science-led, patient-centric approach to deliver improved health outcomes with a lower environmental footprint. As heat and power are critical to the manufacture of medicines, the decarbonization of healthcare requires access to clean sources of heat, such as RNG
- Decarbonization targets
 - AstraZeneca is on track to reduce GHG emissions from its global operations (Scope 1 and 2) by 98% by 2026 from a 2015 baseline
 - By 2030, AstraZeneca aims to halve its entire value chain footprint on the way to becoming science-based net zero by 2045 at the latest
 - The use of RNG at AstraZeneca sites in the US will further enable the company's transition to 100 percent renewable energy for heat and power



Source: AstraZeneca 2024 Sustainability Report; page 6

CASE STUDY: ASTRAZENECA (CONT.)

- Comprehensive framework for considering renewable energy implementation
 - New-to-grid technologies
 - Circular business models
 - Environmental justice
 - Quality of environmental attributes
 - Zero waste to landfill
- November 2023 – Co-lab Partnership
 - Leverage world-class scientific capabilities to enhance composition and biological makeup of Vanguard’s digesters



From left to right: Joris Silon, U.S. country president and senior vice president at AstraZeneca's BioPharmaceuticals Business Unit; John Hanselman, founder and chief strategy officer at Vanguard Renewables; Pam Cheng, EVP global operations & IT and chief sustainability officer at AstraZeneca; Pascal Soriot, CEO of AstraZeneca and Johannes Escudero, Founder & CEO at the Coalition for Renewable Natural Gas.

THE FUTURE: EMERGING MARKETS

RNG DEMAND EXPECTED TO GROW

① Demand Drivers

- **CNG for Transport**
 - CNG is an interim solution to decarbonize fleets before EV solutions are available
- **Residential/commercial utilities**
 - Utility blending targets are becoming more common
- **Industrial Usage**
 - Sustainability commitments drive use in hard to electrify or decarbonize segments
- **Hydrogen**
 - Use as a feedstock to produce green or blue hydrogen which then can be used as a feedstock for other sustainable fuel options or chemicals
- **SAF**
 - Use as a feedstock to produce sustainable aviation fuel
- **Bio-methanol**
 - Use as a feedstock to produce bio-methanol to fuel maritime industry

② Policy Drivers

- **IRA**
 - Funding and incentives for sustainable fuels
- **Utility Mandates**
 - State by state basis
- **International**
 - Mandates and goals
 - Current block on US produced RNG



RNG to grow tenfold by 2050

Demand has outpaced supply with a large increase in planned projects

Source: Deloitte 2024 Renewable Energy Industry Outlook

QUESTIONS

THANK YOU

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