

LMOP Webinar

University of California RNG Projects

January 27, 2021



Welcome and Agenda

Agenda

The Role of RNG in Achieving Carbon Neutrality

Sam Schabacker, Renewable Energy Analyst, University of California

Archaea's Approach: RNG Development and Decarbonization Partnerships

Nicholas Stork, CEO, Archaea Energy, LLC

Questions and Answers

Wrap Up

Mention of any company, association, or product in this presentation is for information purposes only and does not constitute a recommendation of any such company, association, or product, either express or implied, by the EPA.

The Role of RNG in Achieving Carbon Neutrality

How the University of California is reaching carbon neutrality by 2025 with renewable natural gas

Sam Schabacker

Renewable Energy Analyst

University of California Office of the President



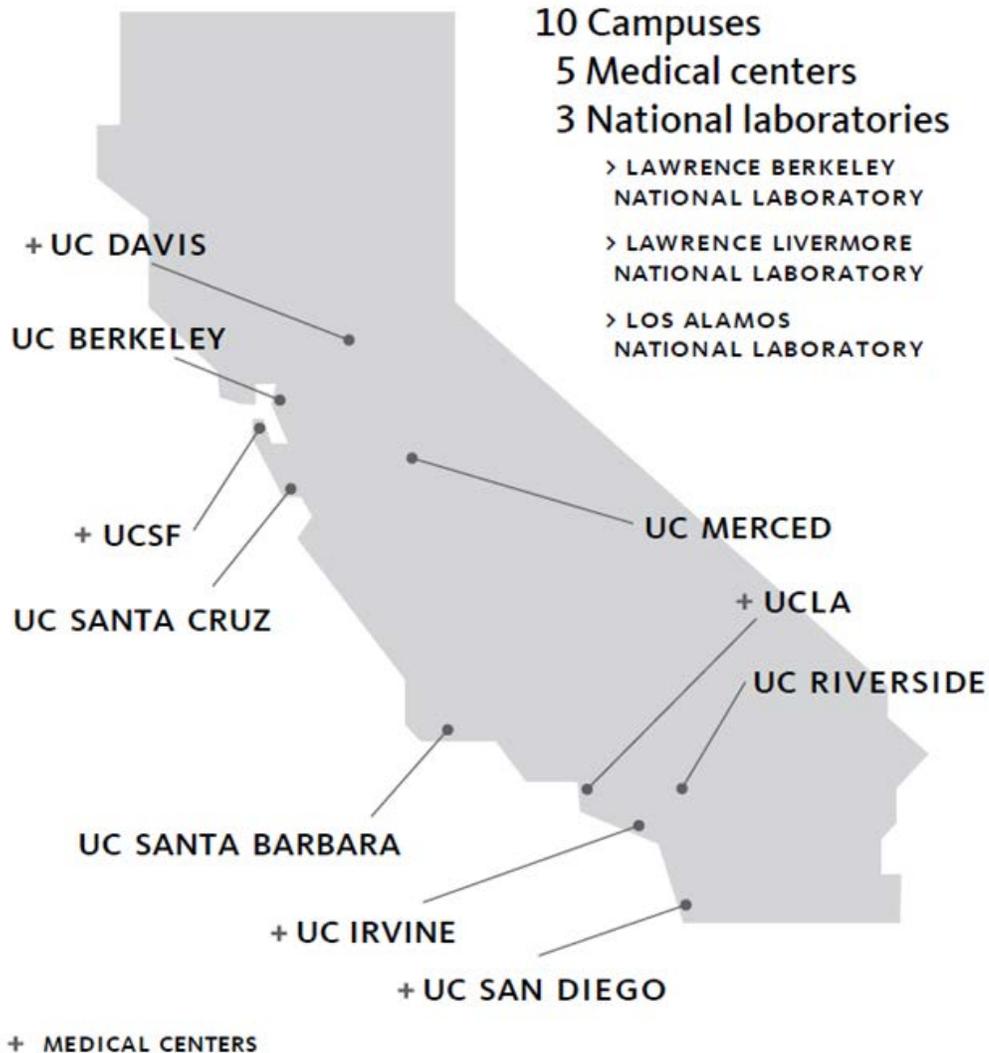
Carbon Neutrality
Initiative

Agenda

- Background on UC
- Carbon Neutrality by 2025
- The Role of RNG

The University of California

The University of California improves the lives of people in California and around the world through world-class educational opportunities, groundbreaking research, top-rated health care and agricultural expertise.



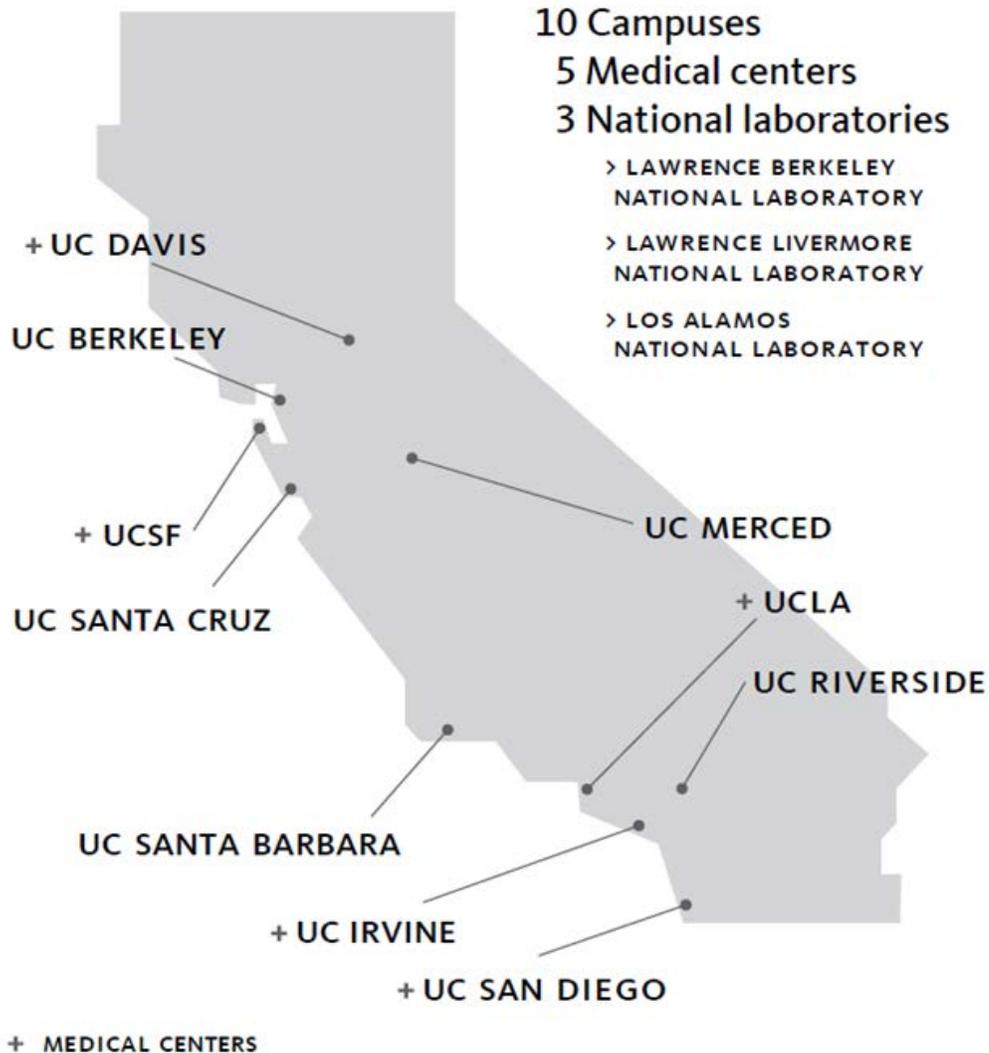
EDUCATION	
Total enrollment	280,380
Undergraduate students	222,493
Graduate students	57,887
Alumni	2.0 M
More than 160 academic disciplines	
More than 800 degree programs	

MEDICAL CENTERS AND CLINICS	
Outpatient visits	4.7 M
Emergency room visits	375,104
Inpatient days by payer	174,839
Medicare patients	31%
Medi-Cal patients	36%

FACULTY AND STAFF	
Faculty	23,300
Other academic (postdocs, etc)	47,000
Staff	157,400

The University of California

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300,000 MT Scope 2

700,000 MT Scope 1

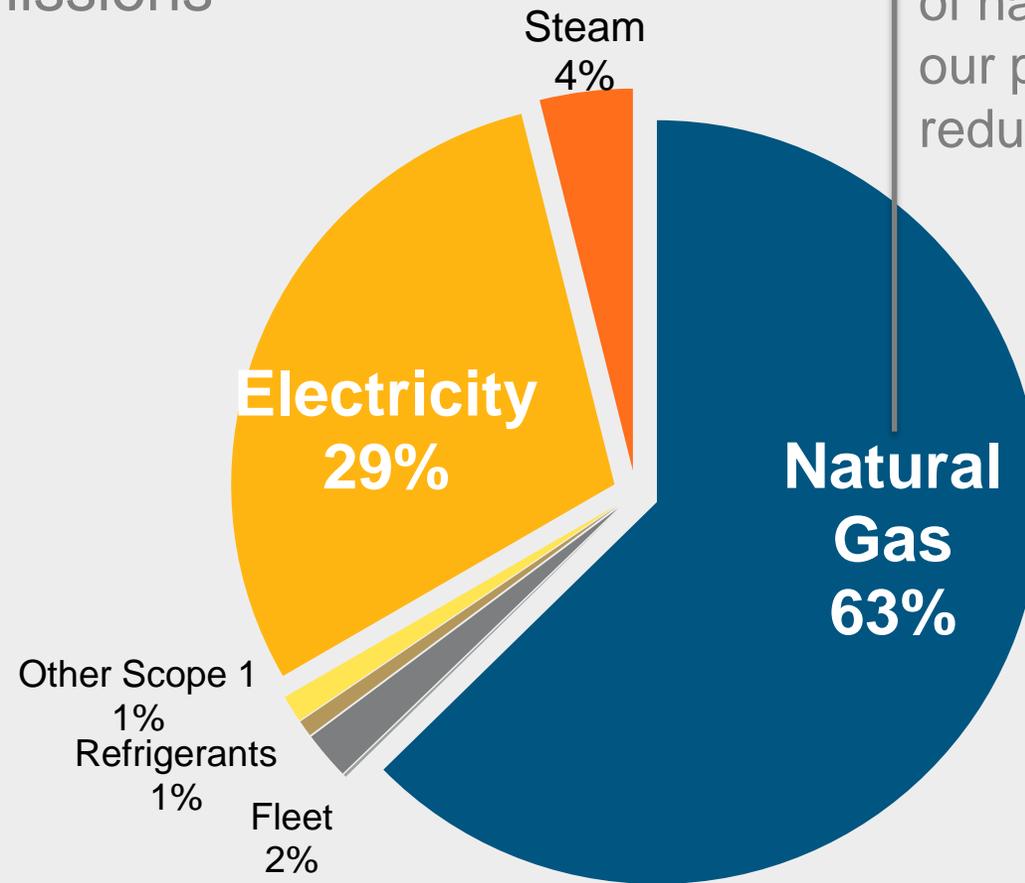
Cogeneration power plants

Boilers

Natural gas combustion

Assessing the Challenge

UC's Current Emissions



The on-campus combustion of natural gas represents our primary challenge in reducing emissions.

Why carbon neutrality matters

UNIVERSITY
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CALIFORNIA

Carbon Neutrality
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UC Carbon Neutrality Initiative

Mission

*University of California's buildings and fleets will become **net carbon neutral by 2025**.*

Vision

*The University of California is developing **scalable solutions** to build the low-carbon future our research has proven to be imperative.*

Our action will:

- *Reflect UC's **core mission** of research, teaching, and public service*
- *Be **financially responsible***
- *Provide **tangible** environmental and social benefits*
- ***Optimize** existing and future campus infrastructure*

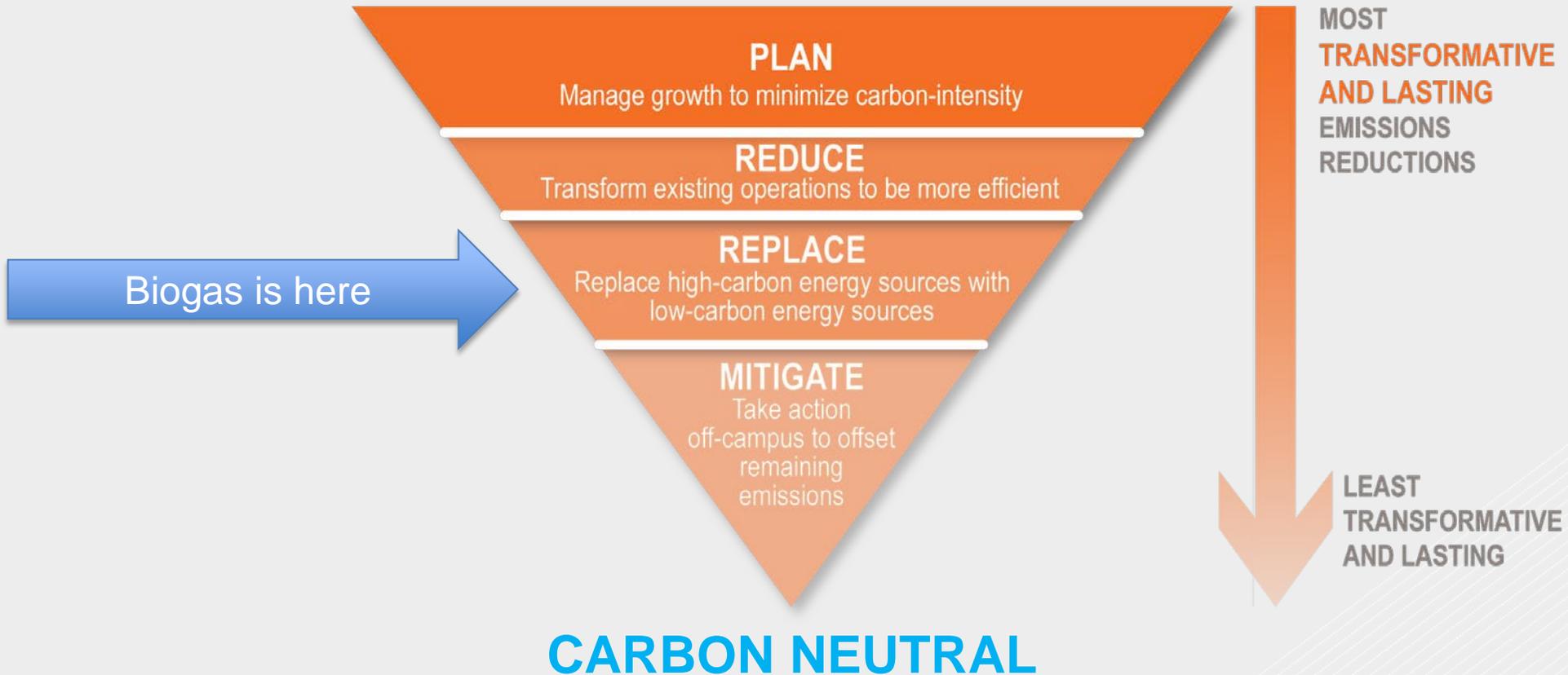
The Plan

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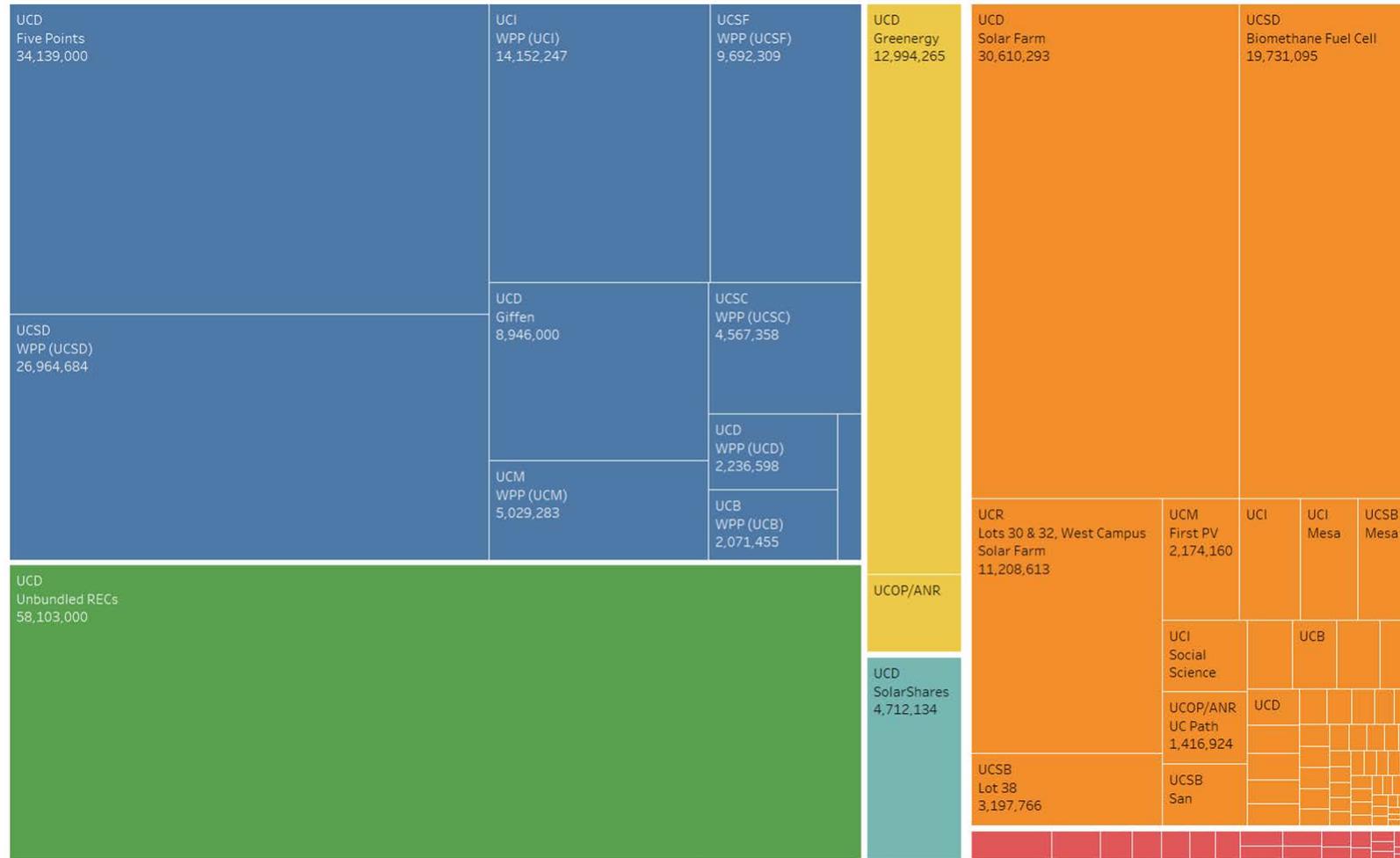
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Prioritizing Solutions

Solution-set Hierarchy, Independent of Cost Considerations



UC now has over 100 renewable energy supplies online



Supply Option Type

- Financial PPA
- Physical PPA
- Self-Supply
- Shared Renewables
- Unbundled RECs
- Utility Product



Green Power Partnership Top 30 College & University

Partner Name	Annual Green Power Use (kWh)
1. University of California	273,347,222

Biogas and UC



Carbon Neutrality
Initiative

Why Biogas Is Part of UC's Carbon Neutrality Strategy

- Alleviates the need for Allowances
- Has great environmental benefits
- Creates useful work, displaces NG
- Assists in capital planning cycle
- Resiliency in a climate change world
- U.S. locations

UC is developing Biomethane projects...



...and signing offtake agreements for Biomethane

The screenshot shows the top navigation bar of the University of California website. The logo 'UNIVERSITY OF CALIFORNIA' is on the left. On the right, there are dropdown menus for 'NEWS', 'PRIORITIES', and 'UC SYSTEM'. Below the navigation bar, a breadcrumb trail reads 'News > Press Room > Investments in new California projects move UC nearly halfway to its clean energy goals'. The main heading is 'Press Room'. On the left side, there is a dark blue sidebar with the title 'CATEGORIES' and a list of links: 'All News', 'Research', 'Health', 'Arts & Humanities', 'Students & Alumni', and 'Faculty & Staff', each with a right-pointing chevron. The main content area features a large article title: 'Investments in new California projects move UC nearly halfway to its clean energy goals'. Below the title, it identifies the author as 'UC Office of the President' and the date as 'Wednesday, October 21, 2020'.

UNIVERSITY OF CALIFORNIA

NEWS ▾ PRIORITIES ▾ UC SYSTEM ▾

News > Press Room > Investments in new California projects move UC nearly halfway to its clean energy goals

Press Room

CATEGORIES

- All News >
- Research >
- Health >
- Arts & Humanities >
- Students & Alumni >
- Faculty & Staff >

Investments in new California projects move UC nearly halfway to its clean energy goals

UC Office of the President
Wednesday, October 21, 2020

UC in the market: We are Buying Gas

- Looking for (a lot of) new supply
 - Cap and Trade eligible
- What UC Brings:
 - Long-term, fixed-price off taker
 - Credit-worthy counterparty (AA)
 - Leading research institution
 - Openness to innovative deal structures

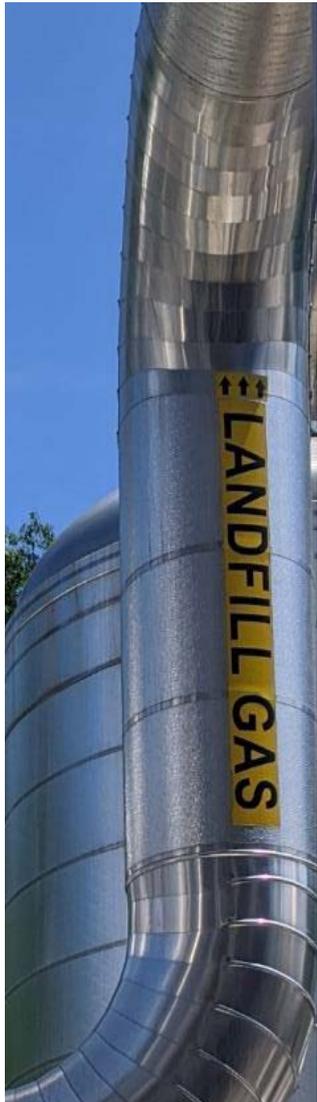
Thank you and please be in touch to
discuss opportunities:
Samuel.Schabacker@ucop.edu



Archaea's Approach: RNG Development and Decarbonization Partnerships

Archaea Energy LLC
Nicholas Stork
Founder, CEO

Archaea Overview



People

- **Industry-leading experts** in project development, engineering, landfill operations, and green gas technology
- Over 200 years of collective experience and more than 100 renewable natural gas (“RNG”) projects

Technology & Innovation

- Archaea’s experts developed much of the **proven RNG technology** relied upon by the market
- At the forefront of innovation in green gas technology, with targeted research and development across **gas separation, CO₂ capture and sequestration, hydrogen, and heat recovery**

Capital Allocation

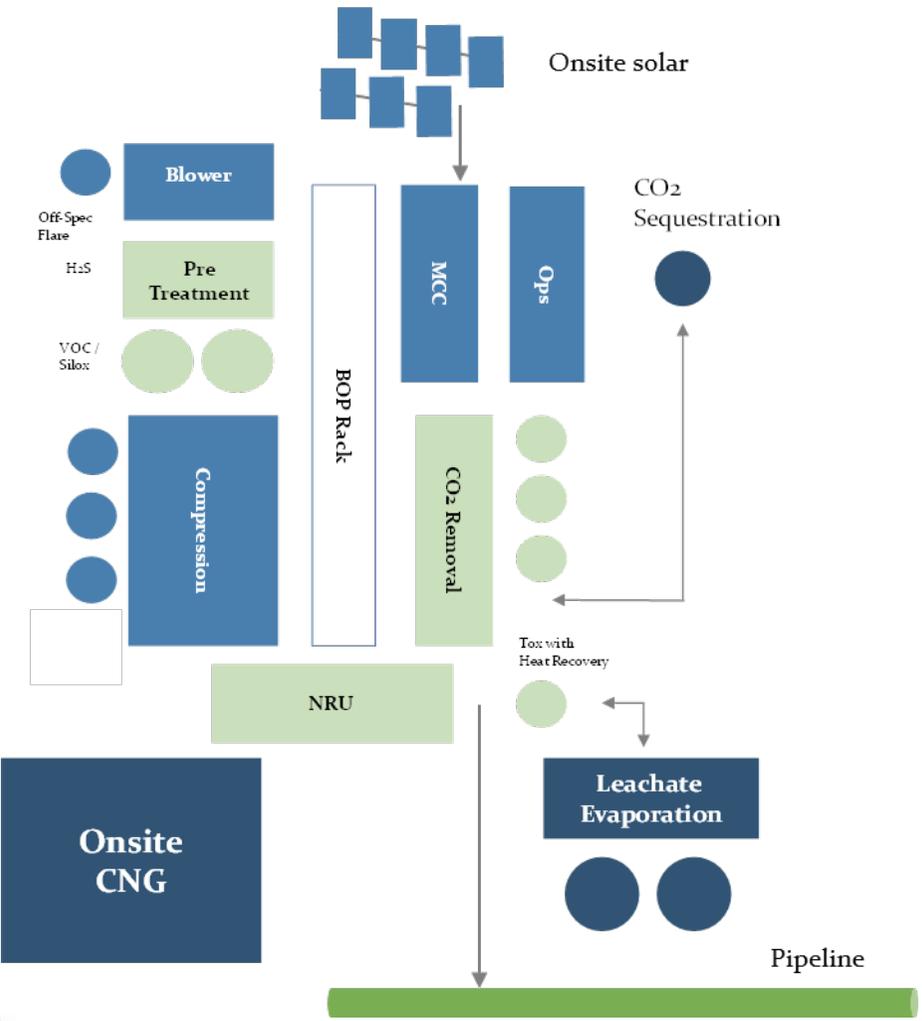
- Backed by successful investors and significant participation from its founders
- Archaea prioritizes **predictable**, long-term gas flow streams for a **20-30 year approach** to project development
- Focused on **long-term RNG offtake agreements** to underpin sustainable RNG project development
- Immune to environmental attribute price fluctuations and political changes

RNG Development

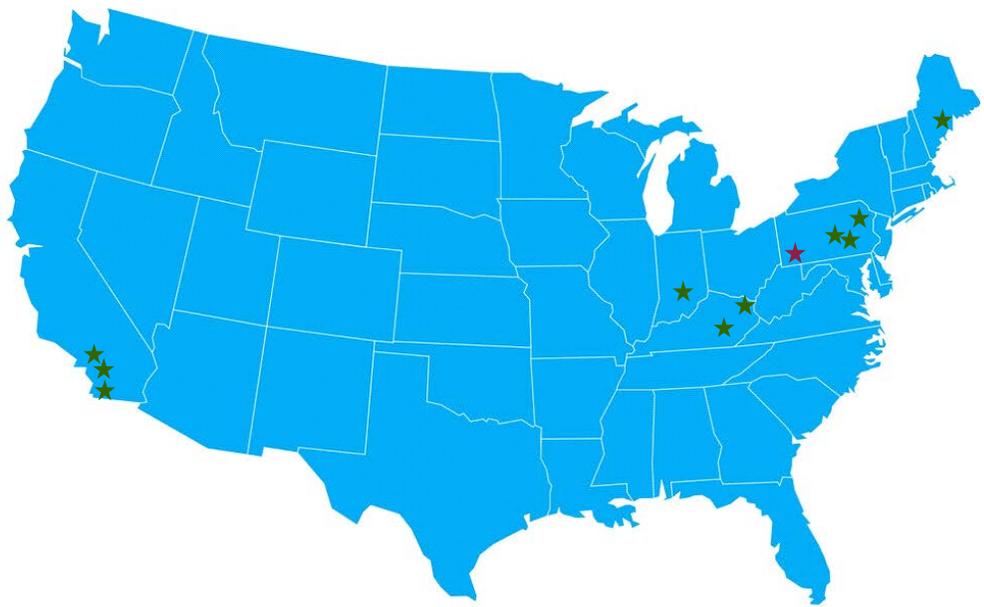
- Developing a **manufacturing approach to RNG development**
- Targeting dramatic reductions in the cost and time to RNG production
- Increasing tolerance of inlet gas qualities, increasing impurity removal efficiencies
- **Reducing carbon intensity** across the development cycle

Current Projects & Approach

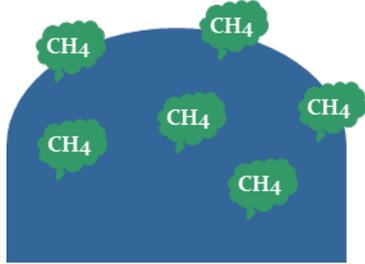
Example Project Layout



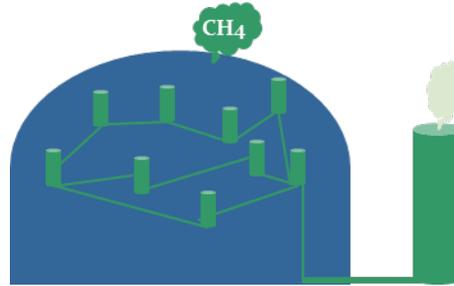
- Included in Archaea Development Pipeline:**
- Renewable energy (solar and waste heat) inputs lowering CI
 - CO₂ capture and sequestration
 - RNG-to-Hydrogen
 - Digesters



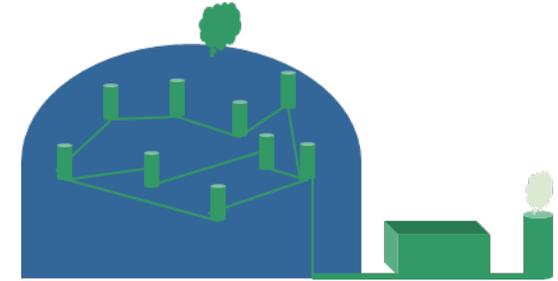
Archaea Project Example – Venting Methane



Landfill without gas collection system



Landfill with gas collection system and flare

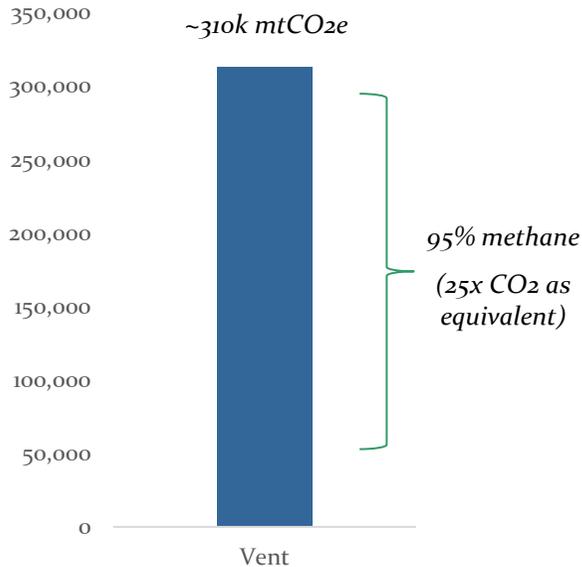


Landfill with gas collection system & Archaea Project

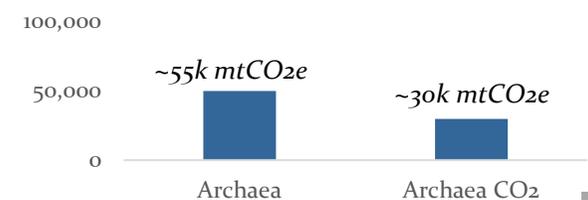
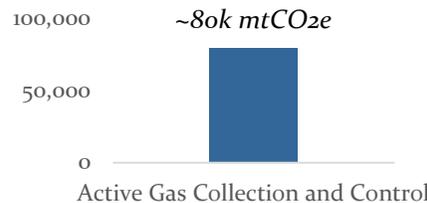
- Landfill is a tier II site based on EPA regulations, determined by NMOC projection

- Vertical wells drilled into landfill with blower and 97%+ destruction efficiency flare
- Best sites capture 80% of the methane
- Tier I site under EPA and NSPS regs

- Landfill gas is cleaned with 90% efficiency and delivered to pipeline, replacing fossil fuels
- Collection efficiency improved with technology and gas revenue incentives
- 99% destruction efficiency thermal oxidizer for non-methane gas
- CO₂ removal and sequestration possible with Archaea approach



250k mtCO₂e/year Reduction in GHG Emissions



The Right Partner: University of California System

Archaea Energy seeks partnerships with world-class organizations that recognize the importance of decarbonization.



- A renowned sustainability pioneer.
- Leads universities nationwide in practical, forward-thinking decarbonization solutions.
- Shares Archaea Energy's long-term vision for RNG and understands how to effectively use RNG as part of its renewable energy portfolio.
- Set challenging Scope 1 thermal emissions reduction goals that could not practically be met by electrification and developed a portfolio-based plan to achieve those goals.
- Seeks partnerships with renewable industry experts like Archaea to find a solution to its emissions reduction goals.



RNG Applications

RNG is a chemically-identical, drop-in replacement to fossil-natural gas for:

Power & Thermal



- For existing onsite power generation and thermal loads at universities, manufacturing facilities, and municipalities
- A renewable and economic alternative to electrification
- Utilization of existing, **non-intermittent**, infrastructure

Hydrogen



- RNG is an efficient, low-carbon feedstock for steam methane reforming (SMR) hydrogen production
- Hydrogen with RNG is a renewable fuel of the future for transportation, power generation, energy storage, steel and aerospace
- RNG can also create electricity for electrolysis

Industrial Feedstocks



- Renewable ammonia: Using RNG instead of natural gas creates green fertilizer and clean fuels
- Renewable methanol: Using RNG as a methanol feedstock lowers carbon intensity for this emerging fuel
- Renewable plastics: Using RNG from landfills as a product input creates a powerful form of recycling in a circular economy

Transportation

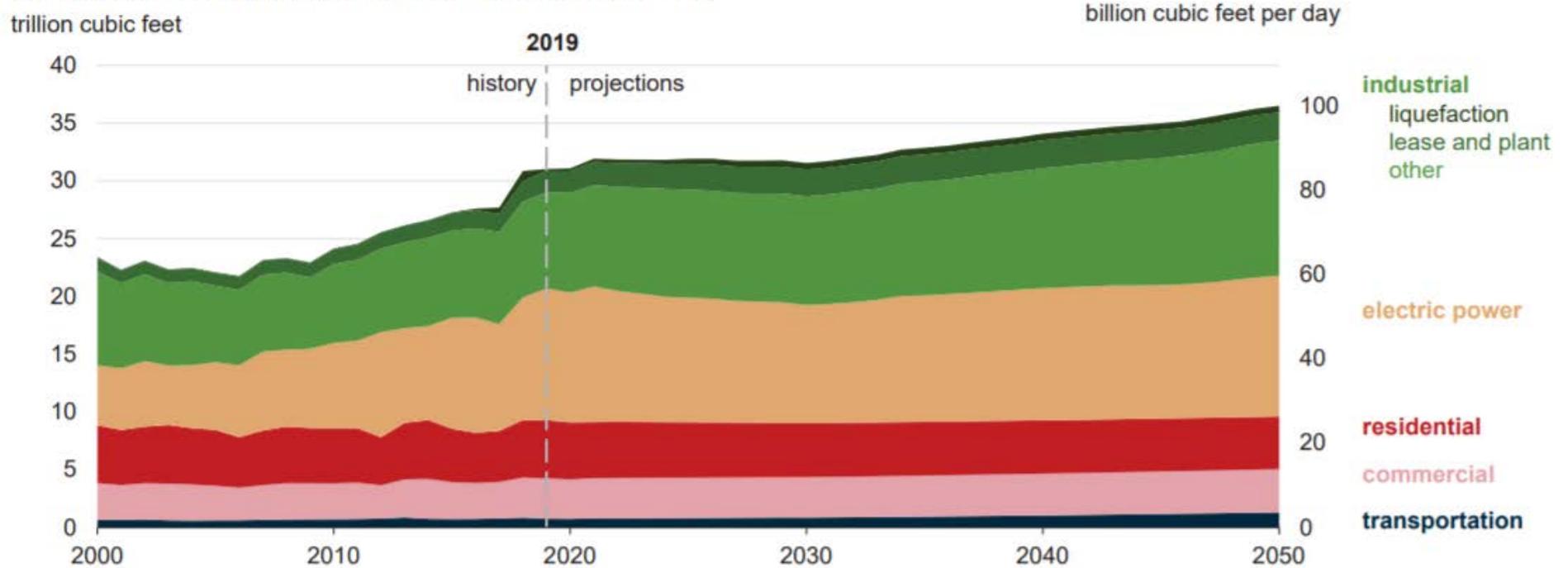


- RNG trucks, busses, cars with proven, efficient CNG engines
- R-CNG + electric for Class 8 trucking
- L-RNG for heavy industrial transportation – shipping and locomotion – replacing low quality diesel to meet emissions standards

RNG: The Need and Challenge

Natural gas is critical for the foreseeable future

Natural gas consumption by sector (AEO2020 Reference case)



U.S. Energy Information Administration

#AEO2020 | www.eia.gov/aeo

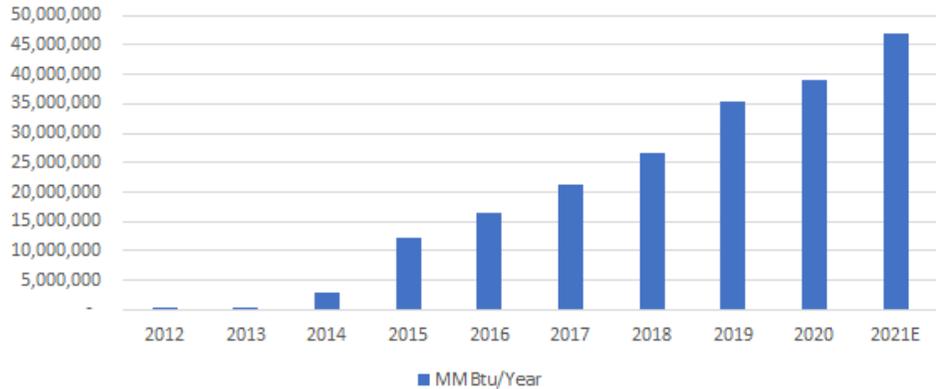
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But, the largest users of natural gas need to decarbonize (by regulation or not)

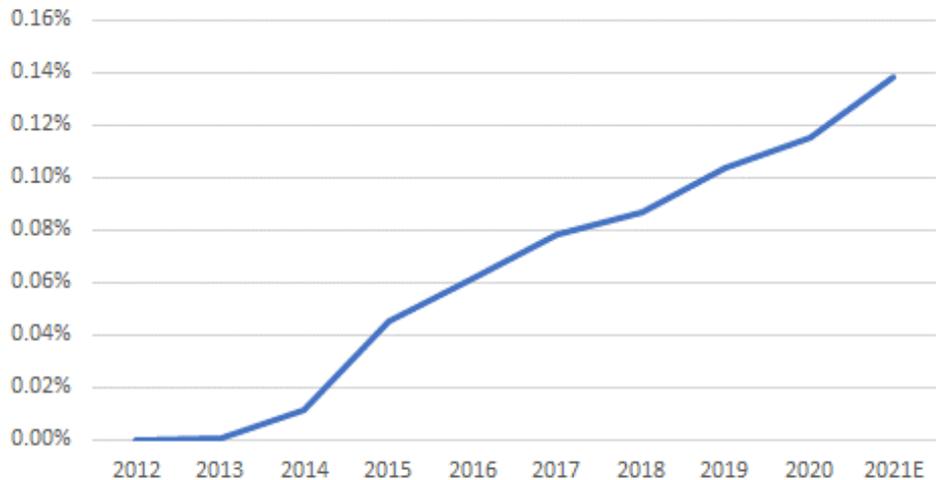
Source: US EIA

RNG: Current Volumes and Market Share

Current RNG Production



RNG % of Total US Natural Gas Production



Can RNG volumes meet the looming demand of 5-10% of the growing natural gas market?

- Yes. But we need to change the way we develop RNG – cheaper, faster, better efficiency, greener.
- We need to open up the (significant) market of smaller flow projects. These projects may also present the following challenges:
 - More difficult gas compositions
 - Longer distances to pipelines

The Value of Long-term RNG Supply

Long-term supply of Archaea RNG gives you a strategic advantage.

Why?

RNG Supply Constraints

- Securing long-term supply for this scarce renewable avoids problems down the road of stranded assets or paying a premium.
- RNG production can only meet about 7-16% of total natural gas demand.
- RNG can replace natural gas for those that move early.

Utility

- Quickly convert existing & proven equipment into environmentally-friendly assets.
- RNG supply is reliable with a multi-layered backup: the first line is Archaea's network of RNG plants & the last line is natural gas. You always have power.

Flexibility

- You own the RNG. Power existing plants & equipment, feed onsite power, or sell the RNG or credits.
- An investment in Archaea RNG now gives you options for the life of the contract.



Partner with Archaea

For more information, please contact us:

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Questions

Q&A

Wrap Up

Contact Information

Wrap Up

- The slides and recording from today's webinar will be posted on the LMOP website
- To learn more about LMOP or LFG energy, visit our website at epa.gov/lmop
- Have a webinar idea? Drop us a note with your email in the Questions box or email lmop@epa.gov



Landfill Methane Outreach Program (LMOP)

The screenshot shows the main content area of the LMOP website. On the left, there is a featured article titled "Renewable Natural Gas (RNG)" with a sub-headline "Learn about RNG sources, end uses, policies and incentives, project examples and more in a new EPA document, [An Overview of RNG from Biogas](#)." Below the text is a collage of images: a cow in a field, a landfill with a yellow excavator, and a long industrial facility. To the right of the article is a sidebar with the heading "CONTACT US" and "SHARE" options for Facebook, Twitter, and Email. Below these are three bullet points: "Partner Reporting", "Webinars and Events", and "Join the LMOP Listserv". At the bottom of the sidebar is the LMOP logo, which features a globe with a blue flame and the text "LANDFILL METHANE OUTREACH PROGRAM".

LMOP is a voluntary program that works cooperatively with industry stakeholders and waste officials to reduce or avoid methane emissions from landfills. LMOP encourages the recovery and beneficial use of biogas generated from organic municipal solid waste. [Learn more about LMOP](#) or [join the LMOP listserv](#).

Key Information



Data and Partners



Tools & Resources



Thank You

Please reach out with any questions or comments

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