Getting the Facts on Renewable Natural Gas

Making California's future **renewable**

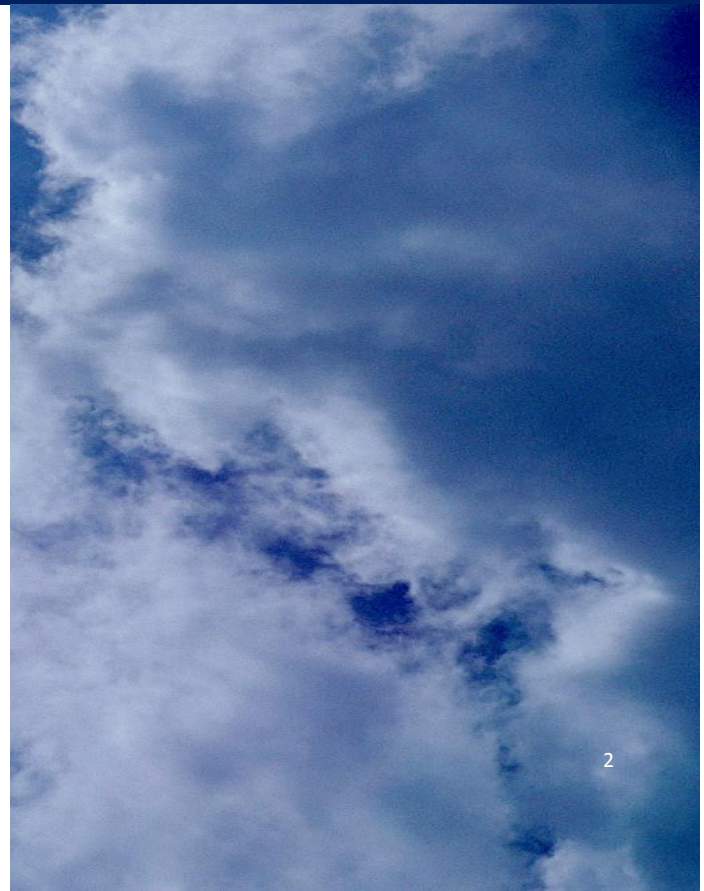
2nd Annual AGA-EPA Natural Gas STAR/Methane Challenge
Renewable Natural Gas Workshop & Exhibit

Presented by Deanna Haines, Director of Energy & Environmental Policy
SoCalGas/SDG&E

Ft. Worth Omni Hotel | October 23, 2018

Preview

- Who We Are
- Context
- RNG Basics
- The Case for RNG
- Projects



SoCalGas A Sempra Energy utility

Who we are...

SoCalGas & SDG&E Territory

Both Utilities in service for over **135 years**

SoCalGas

- **Largest natural gas distribution** utility in the US
- Serve **12 counties** (over 500 communities) and more than **21 million** people
- Over **5.8** million gas meters

SDG&E

- Provides **electricity** and **natural gas** to **3.4 million** people from Orange County to the Mexican border.

Context

RNG Basics

The Case for RNG

California leads the nation in setting climate goals and policy

Governing Law – SB100

By 2030, obtain

60%

of electricity from renewable sources

Governing Law – SB1383

By 2030, reduce methane emissions

40%

below 2013 levels

Executive Order B-55-18

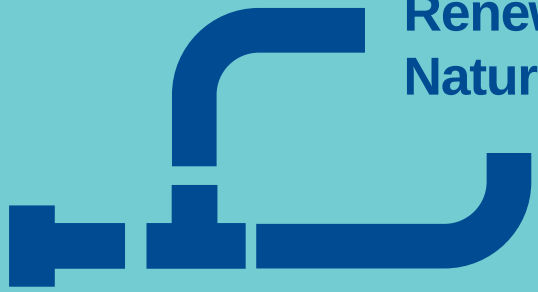
By 2045, economy-wide, become

Carbon Neutral

We need scalable, affordable solutions to solve these issues

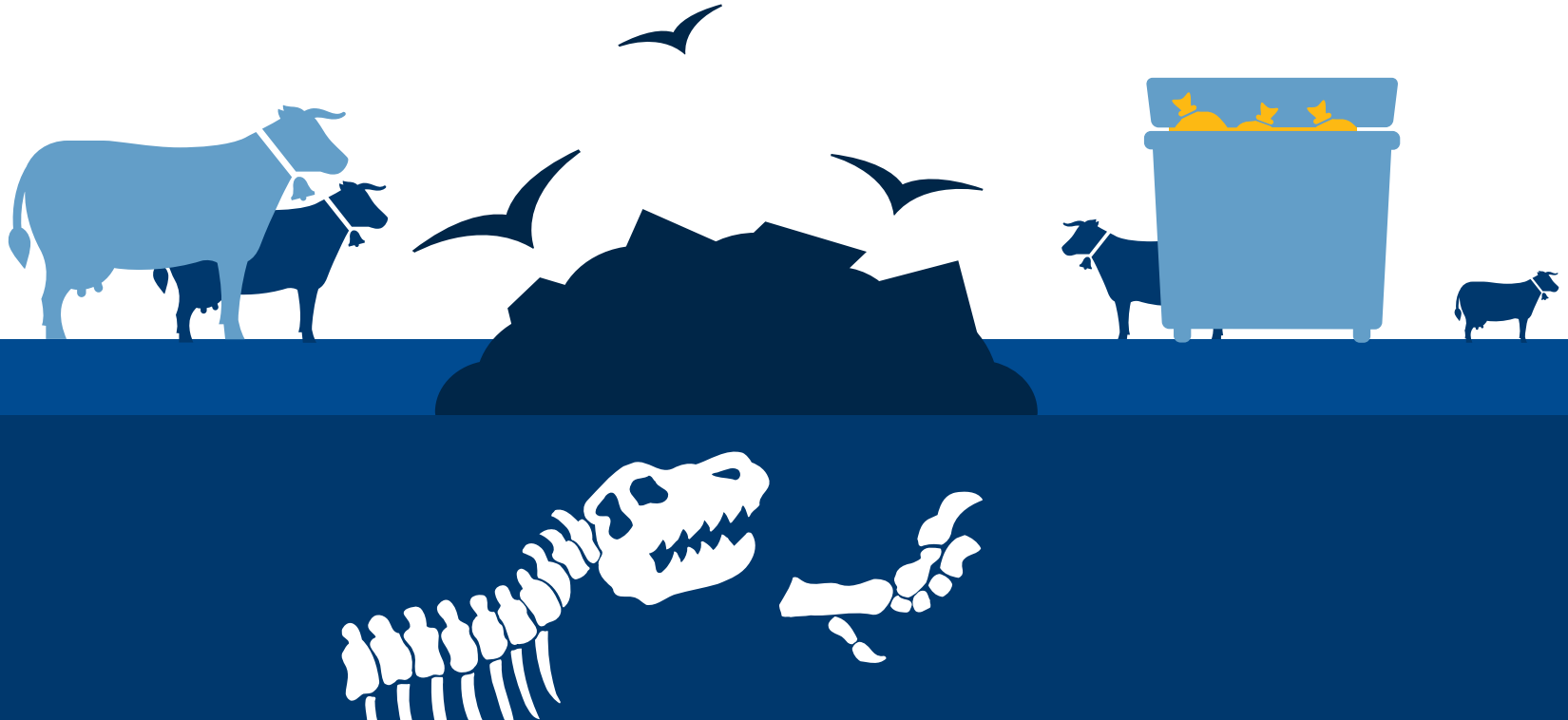
Solar, wind and hydro alone are not enough.

+



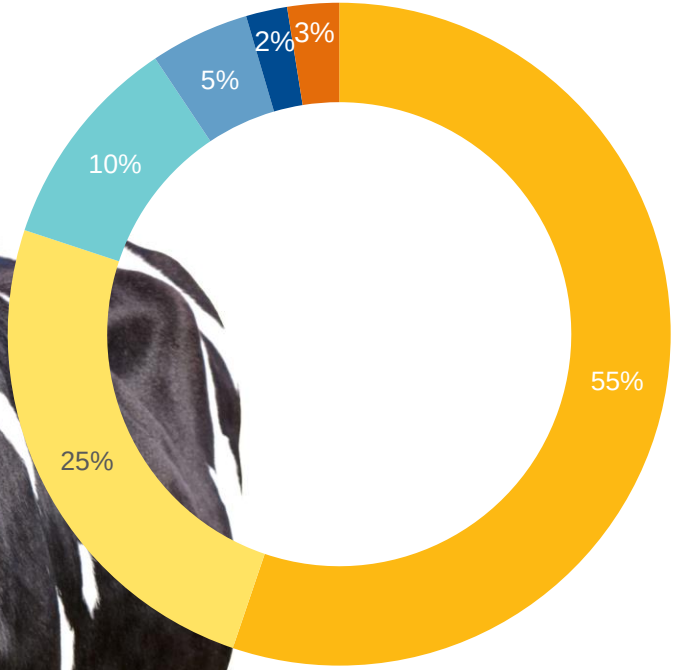
We need to use ALL the tools in our toolbox – including **Renewable Natural Gas.**

Like electricity, natural gas can come from renewable sources



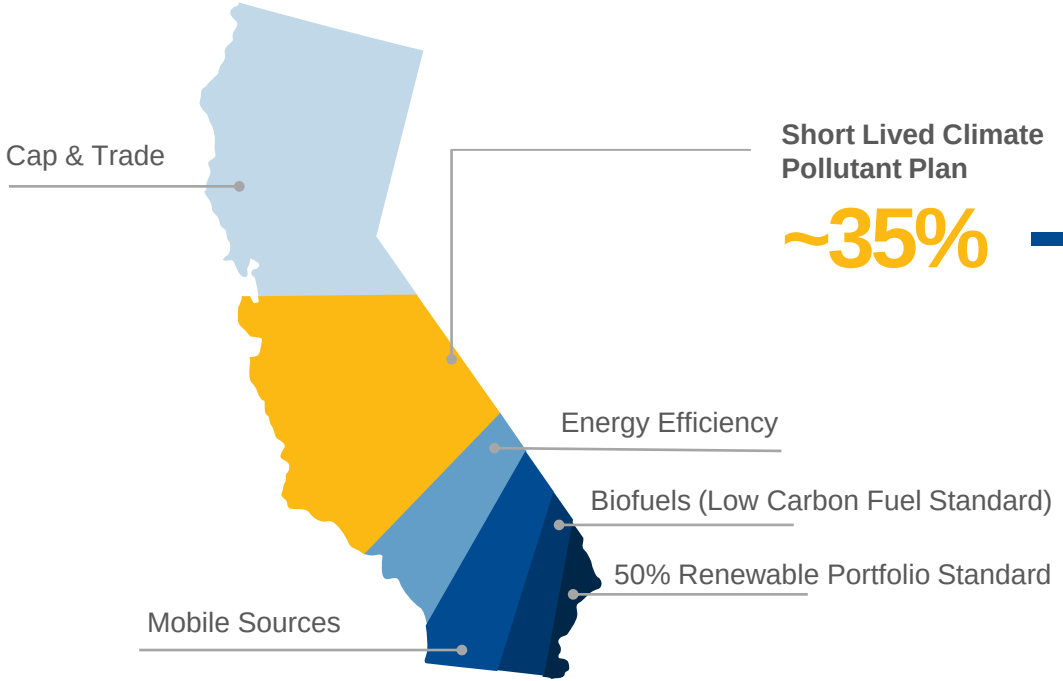
Why is this important?

CA's biggest sources of methane come from our waste streams



Source: California Air Resources Board, 2018 Greenhouse Gases Emissions Inventory, 2016 Methane Emissions

RNG is critical to California's overarching GHG reduction plan



Source: Percentages reflect reductions proposed in California Air Resources Board, AB 32 Updated Scoping Plan (2017)

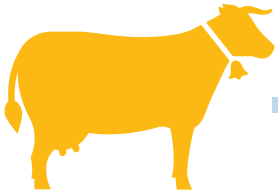
Context

RNG Basics

The Case for RNG

Let’s take a closer look.

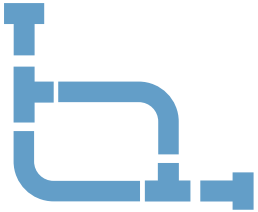
The basics of Renewable Natural Gas



Capture waste from dairies, farms and landfills

Convert into biogas using anaerobic digestion

Process the biogas to make it pipeline-ready (biomethane)



Inject the biomethane into the pipeline for future use

Key terms
defined

Renewable Natural Gas

methane produced from renewable sources like digested organic waste and gasified biomass

Renewable Gas

can be renewable natural gas or hydrogen gas produced from Power-to-Gas.

Biogas

a biofuel that is naturally produced from the decomposition of organic waste during anaerobic digestion. Until biogas is processed to state pipeline standards, it is not considered renewable gas.

Biomethane

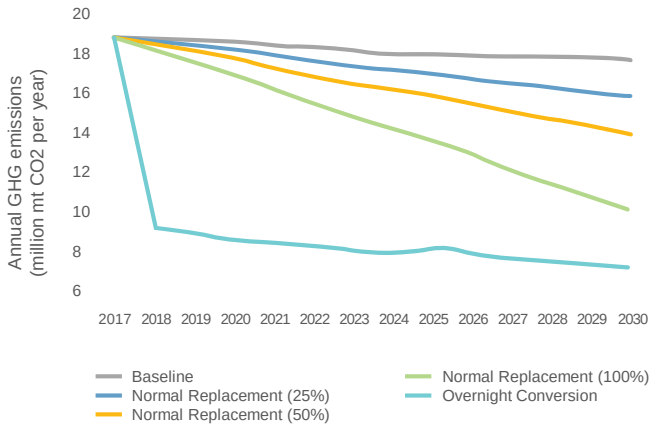
biogas that has been cleaned to state standards and converted to biomethane, which is renewable gas.

Context

RNG Basics

The Case for RNG

Renewable Natural Gas beats building electrification



Proportion of RG required to achieve the same GHG emission savings by 2030

	As a % of buildings gas use	As a % of total gas throughput*
Baseline	0%	0%
Normal Replacement (25%)	12%	4%
Normal Replacement (50%)	23%	8%
Normal Replacement (100%)	46%	16%
Overnight Conversion	63%	22%

*Calculated from % of buildings gas use, assuming that building consumption represents 34% of SoCalGas's total gas throughput in 2030

↗ Achieve 30% emissions reductions in the building sector by switching to

~5% RNG

↗ Achieve the same GHG reductions as overhauling 100% of CA's buildings to all electricity with

~16% RNG

↗ When used as a transportation fuel, RNG from food and Green waste has a

negative carbon intensity

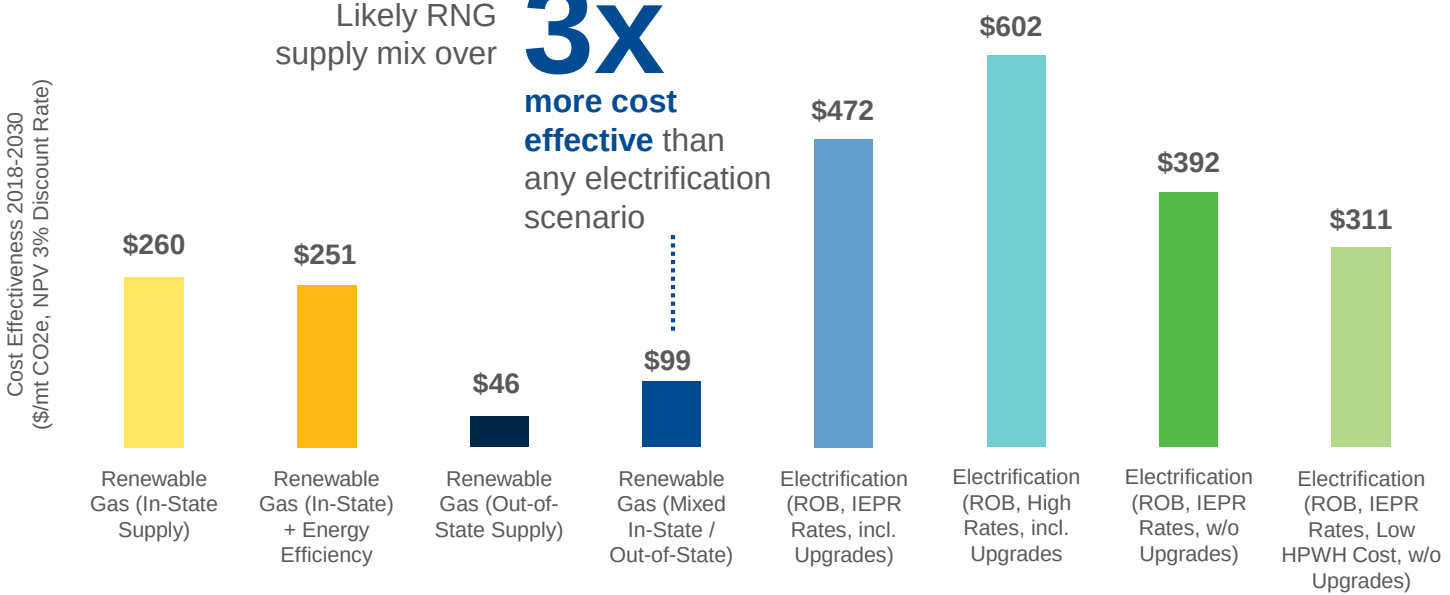
Navigant Consulting, "Gas Strategies for a Low-Carbon California Future," 2018
Bioenergy Association of California, "Decarbonizing The Gas Sector: Why California Needs A Renewable Gas Standard," 2014.

Increasing renewable energy in any form will increase costs, but it is a worthwhile investment

We all agree on that.

Now what we need is a practical plan.

Renewable Natural Gas is also more cost effective



Source: Navigant Consulting, "Gas Strategies for a Low-Carbon California Future," 2018

With RNG, we can achieve our goals with less disruption

In addition to unnecessary costs, electrification would put a heavy burden on consumers.

It would mean:

- Switching out appliances
- Upgrading electric panels
- Rewiring home electric systems

Sources: Navigant Consulting, “Gas Strategies for a Low-Carbon California Future,” 2018

True or False?

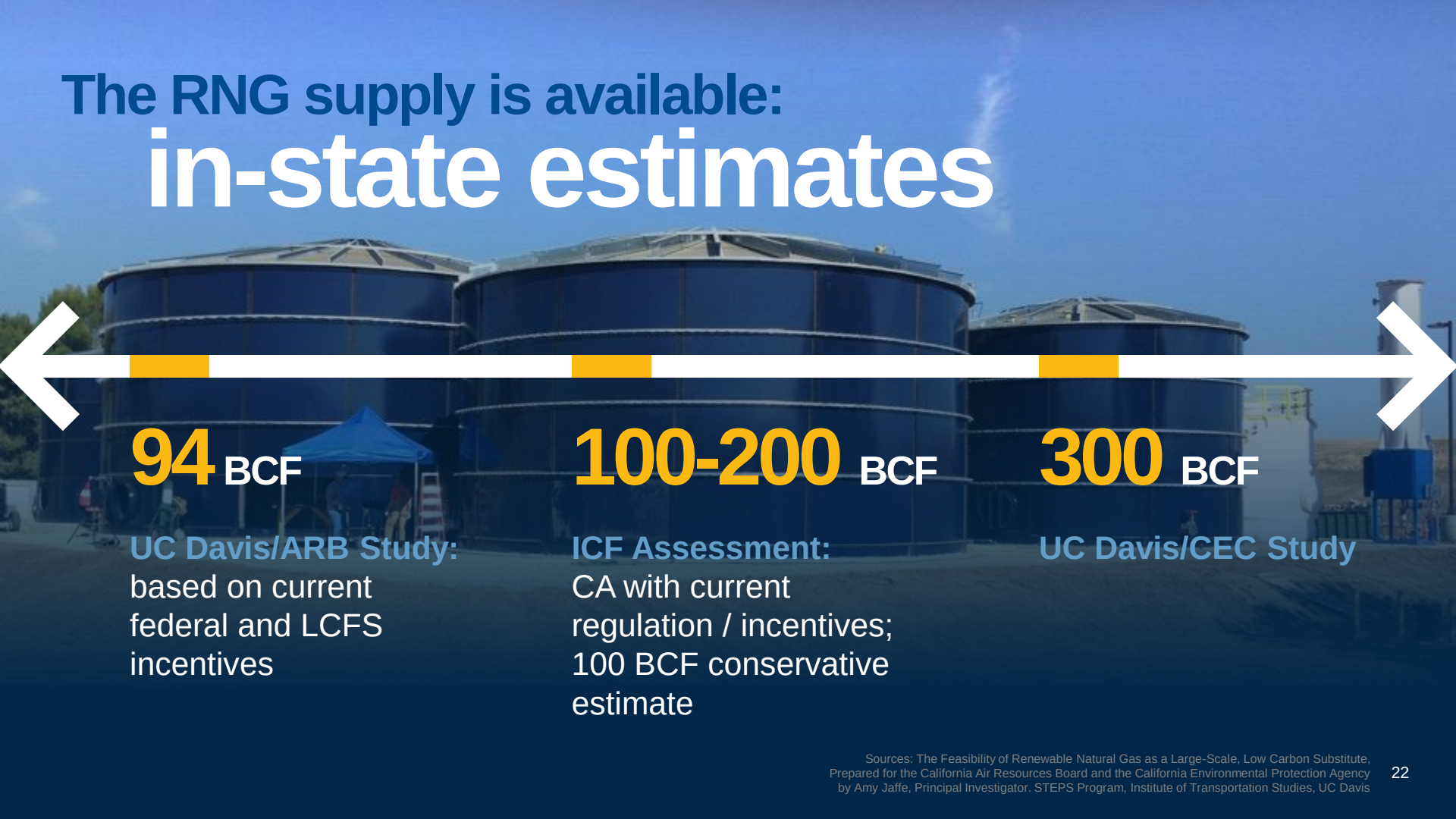
There is enough RNG available to meet CA's 2030 goals.

True

There is a growing supply of RNG in California and the broader U.S.

The RNG supply is available:

in-state estimates



94 BCF

UC Davis/ARB Study:
based on current federal and LCFS incentives

100-200 BCF

ICF Assessment:
CA with current regulation / incentives; 100 BCF conservative estimate

300 BCF

UC Davis/CEC Study

Sources: The Feasibility of Renewable Natural Gas as a Large-Scale, Low Carbon Substitute, Prepared for the California Air Resources Board and the California Environmental Protection Agency by Amy Jaffe, Principal Investigator. STEPS Program, Institute of Transportation Studies, UC Davis

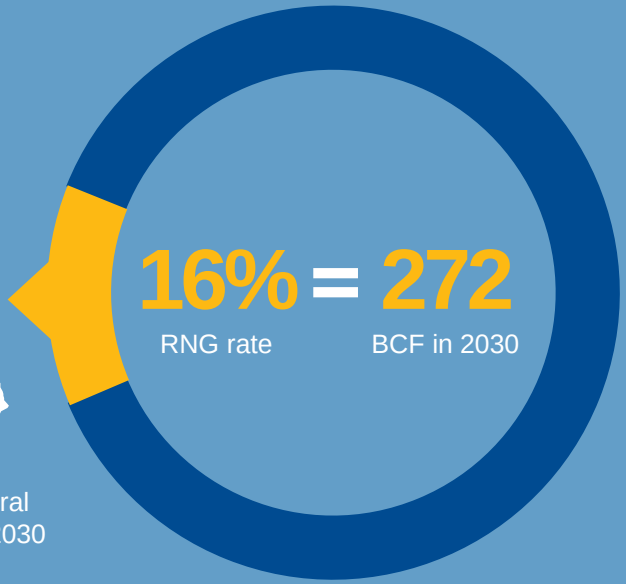
The RNG supply is available:

out-of -state resources

Available in the US today
(and growing)

Projected CA natural
gas throughput by 2030

1.7 TCF



Sources: U.S. Department of Energy. 2016. 2016 Billion-Ton Report: Advancing Domestic Resources for a Thriving Bioeconomy, Volume 1: Economic Availability of Feedstocks. M. H. Langholtz, B. J. Stokes, and L. M. Eaton (Leads), ORNL/TM-2016/160. Oak Ridge National Laboratory, Oak Ridge, TN. 448p. doi: 10.2172/1271651.

But is it feasible?

SoCalGas Biogas Upgrading Demonstration Project at the Hale Avenue Resource Recovery Facility (HARRF)

HARRF Information

Wastewater treatment facility located in Escondido, CA

Average Daily Flow ~ 15.6 MGD

Biogas was being flared prior to start of demonstration project

Biogas Production ~ 95 million cubic feet per year

Biogas contains enough energy to supply ~1,200 homes

Source of photo: www.escondido.org/water-treatment-plant.aspx

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Biofuels Point Loma Renewable Natural Gas Project Overview

- Point Loma Wastewater Treatment Plant treats approximately 175 million gallons of wastewater per day generated by ~2.2 million area residents
- Prior to the project, the plant was flaring more than 1.3 million cubic feet per day of digester gas
- The plant partnered with BioFuels Energy, LLC, to condition/upgrade wastewater digester gas and feed it into the natural gas pipeline system
- Since 2012, the RNG is injected into the utility pipeline and used to power a 2.8 MW fuel cell at UC San Diego and a 1.4 MW fuel cell at South Bay Water Reclamation Plant in San Diego
- Total project cost of $45 million, 75% was subsidized through incentives and tax credits

Data and Photo Sources

https://www.socalgas.com/smart-energy/success-stories/point-loma

https://www.socalgas.com/1443740098116/Biogas-to-RNG-at-Point-Loma-Wastewater-Treatment-Facility.pdf

CR&R Renewable Gas Project Overview

*** Source of picture -** http://www.jrma.com/projectsdetails/cr-r-environmental-center-ad-facility

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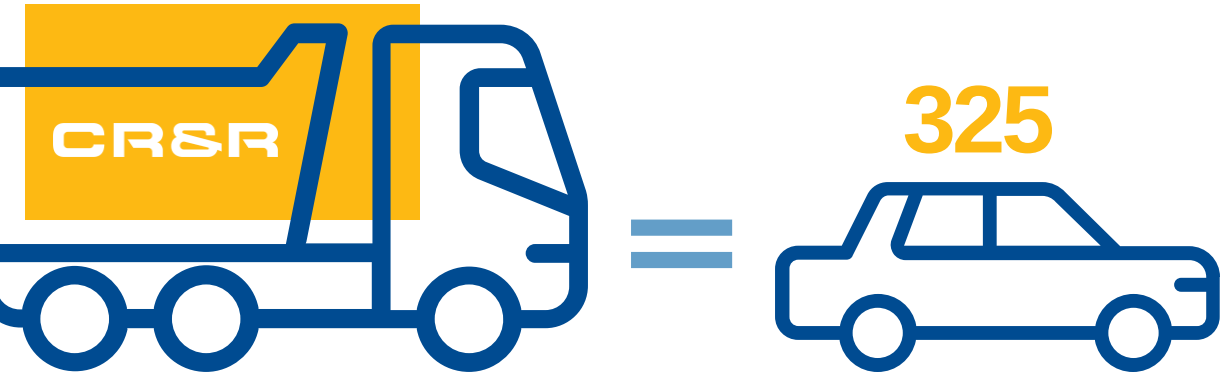
CR&R is turning GHG-laden organic waste into Carbon-neutral renewable natural gas



Near-zero natural gas engines reduce NOx emissions up to 90% and GHG emissions up to 80%.

CR&R's RNG is fueling 400 waste trucks. That’s the equivalent of taking 130,000 cars off the road.

We’re developing a renewable natural gas market to capture emissions and meet CA climate goals

Up to $110 million in grants from the California Department of Food and Agriculture to support new dairy biogas projects.

Thinking globally,

we can have a greater impact

In California, agriculture is responsible for **9%** of our GHG emissions.

However, agriculture accounts for **24%** of **global** GHG emissions.

There's a bigger opportunity globally.

How we innovate matters.

If RNG is so great what is standing in our way?

Underestimating supply.

California has the potential to replace all residential natural gas with RNG.

Short-term thinking.

Research and development is expensive, but the sooner we get going the sooner we see the returns.

Misunderstanding infrastructure.

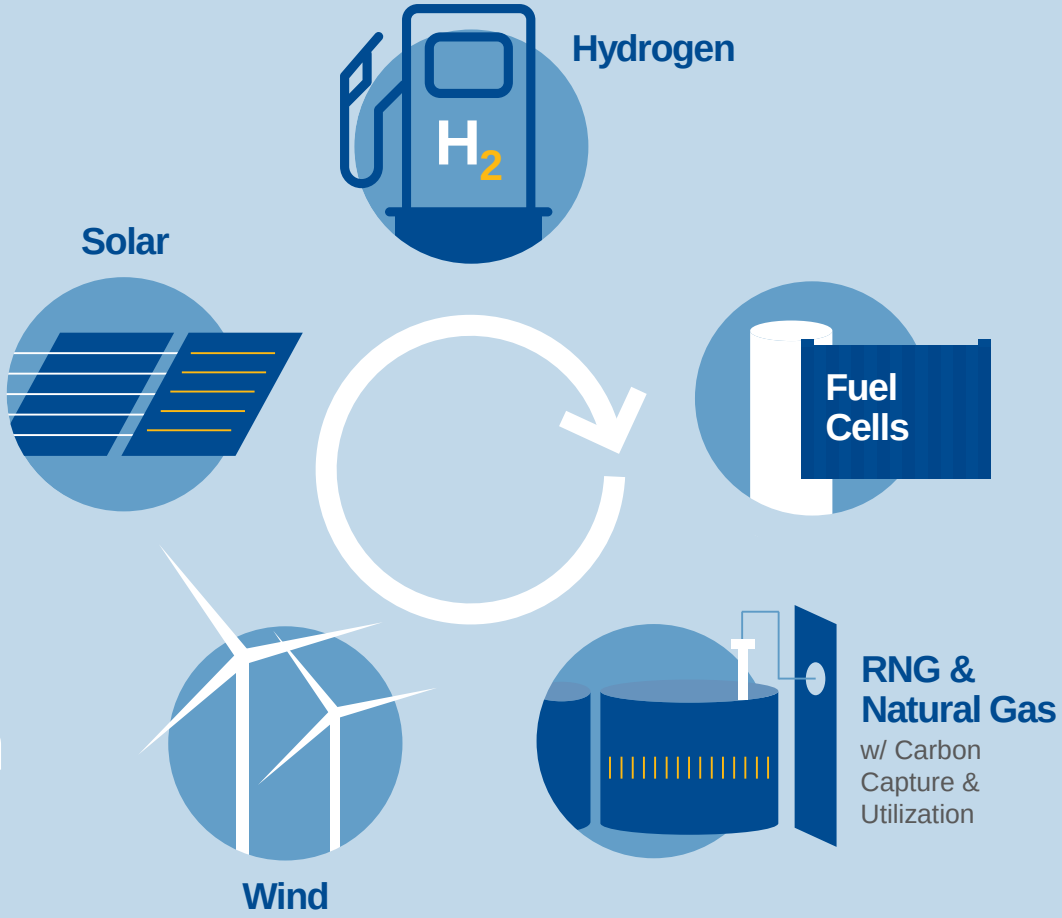
Investments in the pipeline are necessary if we are serious about capturing methane emissions from waste streams.

Lack of perspective.

A narrow focus on combustion leaves out the greater fact that RNG has a net-positive environmental impact.

With a integrated approach

we can achieve our goals and preserve choice, while minimizing disruption and cost



To reach our climate goals we need

renewable natural gas

Support initiatives for capturing methane emissions from waste streams

Set procurement standards to increase the use of RNG by public utilities

Develop the market for renewable natural gas


Thank
You
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Appendix

Interconnection Tools and Process Improvements

Interconnection Tools and Process Improvements

1. **Modify the Existing Rule 30 Gas Quality Deviation Process**
   - Approval of Advice Letter 5128 effective on 5/28/17 allows interconnectors to request a gas quality deviation during the Capacity Study (previously only available starting with the Preliminary Engineering Study)

2. **Gas Quality Outreach and Education**
   - Developed **Information Sheets** to educate the industry on gas quality standards and monitoring
     - **Example**: We frequently hear siloxanes are continuously monitored at our interconnection facilities. Fact is siloxanes are monitored and tested by taking periodic gas samples and sent to a laboratory for testing

3. **Created a Renewable Gas (RG) Section on socalgas.com**
   - Provides information on a variety of RNG topics. *Additional Information and Resources* page provides links to useful reports and websites

4. Developed a downloadable **RNG Toolkit**
   - Available on socalgas.com and topics include: overview of biogas and RNG, interconnection procedure, gas quality standards, interconnection monetary incentive program, and tools/tips for biogas to pipeline projects

5. **Streamline the Interconnection Process**
   - Reviewed the existing interconnection process to improve/enhance the experience for the interconnector and company personnel

RNG Toolkit
(Available at socalgas.com/rg)


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BIOGAS CONDITIONING/ UPGRADING SERVICES TARIFF
The Biogas Conditioning/Upgrading Services Tariff is a fully elective, optional, nondiscriminatory tariff service for customers that allows SoCalGas® to plan, design, procure, construct, own, operate, and maintain biogas conditioning and upgrading equipment on customer premises. The biogas will be conditioned/upgraded to the gas quality specifications as requested by the customer and agreed to by SoCalGas.
KEY ELEMENTS
• The Biogas Conditioning/Upgrading Services Tariff is a fully compensatory service paid by participating customers. Monthly tariff service pricing will vary based on the size, scope and location of each project.
• The Biogas Conditioning/Upgrading Services Tariff will be provided through a long-term Service Agreement, typically 10-15 years. At the end of the contract term, customer may request to extend the term of the agreement or ask SoCalGas to remove the equipment.
• The tariff service is neither tied to any other tariff or non-tariff services the customer may receive from SoCalGas nor will it change the manner in which those services are delivered.
• Non-utility service providers may offer services that are the same or similar to the Biogas Conditioning/Upgrading Services Tariff and customers are encouraged to explore these service options.
• To assist customers in understanding all of their service options, SoCalGas maintains and provides customers with a list of non-utility service providers.
Is the Biogas Conditioning/Upgrading Services Tariff mandatory if customers want to put renewable natural gas (biomethane) into the pipeline?
No. Customers may elect to install and maintain their own biogas conditioning and upgrading equipment or engage a third party to install and maintain their biogas conditioning and upgrading equipment rather than take the Biogas Conditioning/Upgrading Services Tariff from SoCalGas.
Does enrollment in this tariff result in any preferential treatment when it comes to getting gas service?
No. The Biogas Conditioning/Upgrading Services Tariff is a fully elective, optional, non-discriminatory tariff service that is neither tied to any other tariff or non-tariff services the customer may receive from SoCalGas nor will it change the manner in which these services are delivered. As an example, requests for an interconnection capacity study are processed on a "first come, first served" basis for all customers, including customers that elect to take the Biogas Conditioning/Upgrading Services Tariff and customers that do not.
Who can receive service under the Biogas Conditioning/
FREQUENTLY
What are some
that would use
Examples of cus
be served by the
Tariff include: bi
for pipeline injec
refueling station
combined heat a

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RENEWABLE NATURAL GAS
PART OF CALIFORNIA'S RENEWABLE ENERGY FUTURE
WHAT IS RENEWABLE NATURAL GAS?
Traditionally, pipeline natural gas comes from deep underground wells and is often associated with petroleum production. On the other hand, renewable natural gas (RNG) is natural gas derived from organic waste material found on the surface of the earth. In California, and throughout the United States, there are a variety of sources of this organic waste, which we see in daily life. These include food waste, garden and lawn clippings, animal and plant-based material as well as degradable carbon sources such as paper, cardboard and wood. The abundance of this material can allow for production of biogas in significant quantities.
The most common source of biogas is the naturally-occurring biological breakdown of organic waste at facilities such as wastewater treatment plants and landfills. Biogas typically consists of methane and carbon dioxide, with traces of other elements. Biogas is cleaned and conditioned to remove or reduce non-methane elements in order to produce RNG. The converted RNG is then put into the utility pipeline as a replacement for traditional natural gas. This process helps promote the safe and reliable operation of the natural gas pipeline distribution network as well as the natural gas equipment and appliances used by customers.
HOW ORGANIC WASTE IS CONVERTED INTO RNG
1. Waste products, such as sludge, food waste or manure are processed in a biodigester.
2. The biodigester breaks down the organic material to create biogas – a mixture of methane and other elements.
3. The biogas can then be processed and conditioned leaving behind RNG, which can be used interchangeably with traditional natural gas.
4. This RNG can be used where it is produced for things like generating electricity or fueling vehicles, or it can be injected into a utility pipeline for transportation to other customers.
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BIOGAS SUPPLIER LIST
NORTH AMERICA
UNITED STATES

Acrion Technologies http://www.acrion.com	7777 Exchange Street, Suite 5 Cleveland, OH 44124	314-669-2612
BioCNG, LLC http://www.biocng.us	8413 Excelsior Drive, Suite 160 Madison, WI 5371	630-410-7202
CH4 Biogas http://ch4biogas.com/	30 Lakewood Circle N Greenwich, CT 6830	203-869-1446
Energy Fuels //www.cleanenergyfuels.com/company/ uablefuels.html	4675 MacArthur Court, Suite 800 Newport Beach, CA 92660	949-
Horizons, LLC //www.clearhorizonsllc.com	5070 N. 35th Street Milwaukee, WI 53209	414-
y Energy Partners //www.colonyenergypartners.com	4940 Campus Drive, Suite C Newport Beach, CA 92660	949-
ble Biogas //www.columbiabiogas.com/	PO Box 4120, Suite 55888 Portland, OR 97208	503-
lorp //www.ecocorp.com/	1211 S Eads Street Arlington, VA 22202	703-
mann Corporation //www.eisenmann.com	150 East Dartmore Drive Crystal Lake, IL 60014	815-


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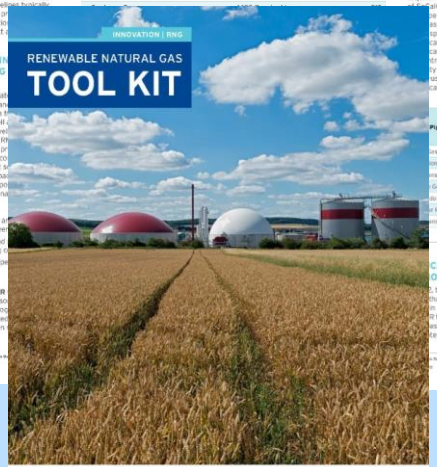
TOOLS AND TIPS
FOR RENEWABLE NATURAL GAS (RNG) PROJECTS CONNECTING TO THE SOCALGAS® PIPELINE
Once RNG is conditioned and upgraded, it can be injected into the SoCalGas pipelines. But, location of the interconnection is critical. A nearby pipeline must have the capacity to accept the volume of RNG produced. Customer demand fluctuates daily and seasonally, and natural gas pipeline typically flow in one direction – from higher p systems to lower pressure distributio this reason, SoCalGas must conduct analysis to find a feasible location.
WHAT FACTORS DETERMIN VIABILITY OF PRODUCING RNG*?
The necessary components and relat condition and upgrade raw biogas a the pipeline can vary, depending on and quality of the raw biogas as well location. Below a certain quality leve may not be economical to produce R incentives. Typically, the larger the p cleaner the raw biogas, the more eco feasible that project will be. Project s the only design factor that may inca economics. Some other major compo can play a significant, but often mana project costs are:
• Equipment to remove nitrogen a (capital and operating cost driver
• Compression for processing and injection (capital and operating
• Long-distance high pressure pipe extension (capital cost driver)
1. REMOVING NITROGEN AND/OR
Often landfills and other biogas s air infiltration, meaning that nitrog oxygen can be inadvertently mixed biogas. Both nitrogen and oxygen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RENEWABLE NATURAL GAS
TOOL KIT
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RENEWABLE NATURAL GAS (RNG)
GAS QUALITY STANDARDS
THE SOCALGAS® GAS QUALITY STANDARDS
SoCalGas® Rule 30 describes the requirements for gas to be injected into the utility pipeline. These requirements reflect the first and foremost priority GAS to protect its customers, employees, pipeline system. The standards cover two aspects: gas constituent limits (composition-specifications) and gas interchangeability (operations performance-based quality cations). Gas constituent limits restrict the ration of gas impurities to protect pipeline ty and ensure safe and proper combustion user equipment. The interchangeability cations address end-user combustion
performance, ensuring safe and proper combustion for customers.
SoCalGas Rule 30, Section I.5. provides interconnectors with the option to request specific deviations from meeting the defined gas quality specifications in Section I.3. If SoCalGas determines such gas will not negatively impact system operations, SoCalGas is then required to file an Advice Letter for California Public Utilities Commission (CPUC) appr permitted to flow into the
The table below shows s from across the United S are specific to each pipeli

Pipeline Company	Heating Value (Btu/scf) Min	Max	Water Content (Lbs/MMscf)	CO2	Various In O2
	990	1150	7	3%	0.20%
on Transmission	967	1100	7	3%	0.20%
ns LP	970	–	7	3%	0.20%
Gas Transmission Co.	1000	1110	7	1%	0.25%
o Interstate Gas Co.	968	1235	7	3%	0.00%
e Pipeline Co.	950	1150	5	2%	0.10%
mission Northwest Co.	995	–	4	2%	0.40%

CAL GAS CONSTITUENTS FOUND OGAS
E the CPUC issued a decision in the hane Phase I Order instituting Rulemaking in response to AB 1900 (Gatto, 2012). In R the PUC, in collaboration with other state ies, adopted 17 constituents of concern that entially be found in biogas. Reasonably
acceptable levels of these human health and system and ordered to be include (see Section J.5). As dire protection levels for each monitoring, testing, repor requirements are reviewe five years, or sooner, if n available.


OVERVIEW
Renewable Natural Gas (RNG), also known as "Biomethane," is biogas that has been processed and upgraded to be interchangeable with traditional natural gas. RNG that meets the standards adopted pursuant to California Health and Safety Code Section 25420 can be put, or injected, into the existing utility natural gas pipelines. SoCalGas® Rule No. 30, "Transportation of Customer-owned Gas," describes the specifications, terms and conditions adopted that must be met in order for SoCalGas to accept RNG into its pipeline network.
The process begins with biogas, which is produced by the anaerobic decomposition of organic material, which occurs naturally. This process happens at facilities such as landfills, landfill diversion facilities,
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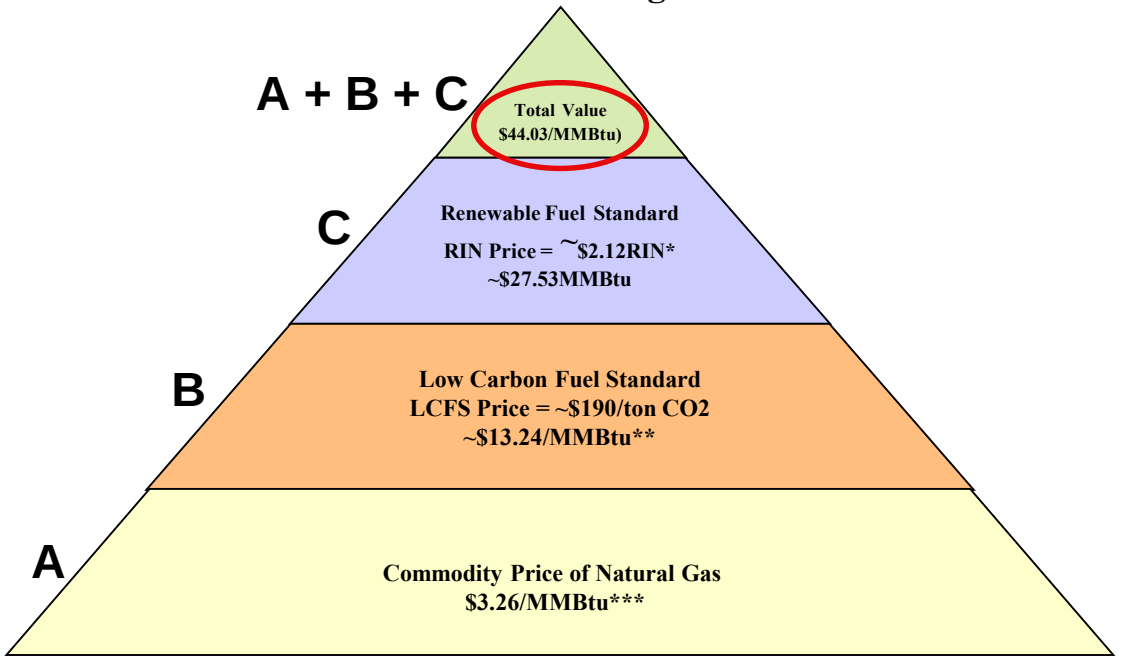
RENEWABLE NATURAL GAS INTERCONNECTION PROCESS
dairies and wastewater treatment plants. This raw biogas is made up of mainly methane and carbon dioxide, with traces of other elements such as water, hydrogen sulfide, siloxanes, nitrogen, and oxygen. Prior to injection into the pipeline, biogas must be conditioned and upgraded to remove or reduce non-methane elements to promote the safe and reliable operation of the pipeline network and end-use natural gas equipment.
BIOGAS PROCESSING TECHNOLOGIES
There are several methods and technologies available to condition biogas. Technology selection can be based on many criteria, including biogas and product gas makeup and site and operating conditions. Some examples of technologies used in biogas conditioning:
• High-selectivity membranes
• Pressure swing adsorption systems
• Water scrubbing systems
• Solid scavenging media
• Regenerative or non-regenerative adsorbent media
• Catalytic O_2 removal
It is common to find a combination of these technologies working in conjunction to meet a set of specification.
BIOMETHANE INJECTION PROCESS
SoCalGas Rule No. 39, "Access to the SoCalGas Pipeline System," provides detailed information on the requirements to interconnect and inject natural gas into utility pipelines. The section below describes the three basic steps of the interconnection process.
Biomethane Producer's Piping
Utility Interconnection
SoCalGas Pipeline Network


SOUTHERN CALIFORNIA GAS COMPANY Revised Cancelling Revised
Rule No. 30 Sheet 1
TRANSPORTATION OF CUSTOMER-OWNED GAS
The general terms and conditions applicable whenever the Utility System Operator transports customer-owned gas, including wholesale customers, the Utility Gas Procurement Department, other end-use customers, aggregators, marketers and energy customers (referred to herein as "customers") over its system are described herein.
A. General
1. Subject to the terms, limitations and conditions of this rule and any applicable CPUC authorized tariff schedule, directive, or rule, the customer will deliver or cause to be delivered to the Utility and accept on redelivery quantities of gas which shall not exceed the Utility's capability to receive or redeliver such quantities. The Utility will accept such quantities of gas from the customer or its designee and redeliver to the customer on a reasonably consistent basis on equivalent quantity, on a therm basis, to the quantity accepted.
2. The customer warrants to the Utility that the customer has the right to deliver the gas provided for in the customer's applicable service agreement or contract (hereinafter "service agreement") and that the gas is free from all liens and adverse claims of every kind. The customer will indemnify, defend and hold the Utility harmless against any costs and expenses on account of royalties, payments or other charges applicable before or upon delivery to the Utility of the gas under such service agreement.
3. The point(s) where the Utility will receive the gas into its intrastate system (point(s) of receipt, as defined in Rule No. 1) and the point(s) where the Utility will deliver the gas from its intrastate system to the customer (point(s) of delivery, as defined in Rule No. 1) will be set forth in the customer's applicable service agreement. Other points of receipt and delivery may be added by written amendment thereof by mutual agreement. The appropriate delivery pressure at the point(s) of delivery to the customer shall be that existing at such point(s) within the Utility's system or as specified in the service agreement.
B. Quantities
1. The Utility shall at nearly as practicable cash-out redeliver to customer and customer shall accept, a like quantity of gas as is delivered by the customer to the Utility on each day. It is the intention of both the Utility and the customer that the daily deliveries of gas by the customer for transportation hereunder shall approximately equal the quantity of gas which the customer shall receive at the point(s) of delivery. However, it is recognized that due to operating conditions either (1) in the fields of production, (2) in the delivery facilities of third parties, or (3) in the Utility's system, deliveries into and withdrawals from the Utility's system may not balance on a day-to-day basis. The Utility and the customer will use all due diligence to assure proper load balancing in a timely manner.

What are the Market Drivers to Produce RNG?

(Estimated Total Value of RNG When Used as a Transportation Fuel in CA)

For WWTP Biogas



Prices as of 10/05/18

* 2018 Vintage D3 RIN's

** Assumes carbon intensity for WWTP of 30 $gCO2/MJ_3$

*** Approximate Henry Hub Natural Gas Future Price – Nov 2018

http://progressivefuelslimited.com/Auth_RIN/PFL_RIN_Recap.pdf

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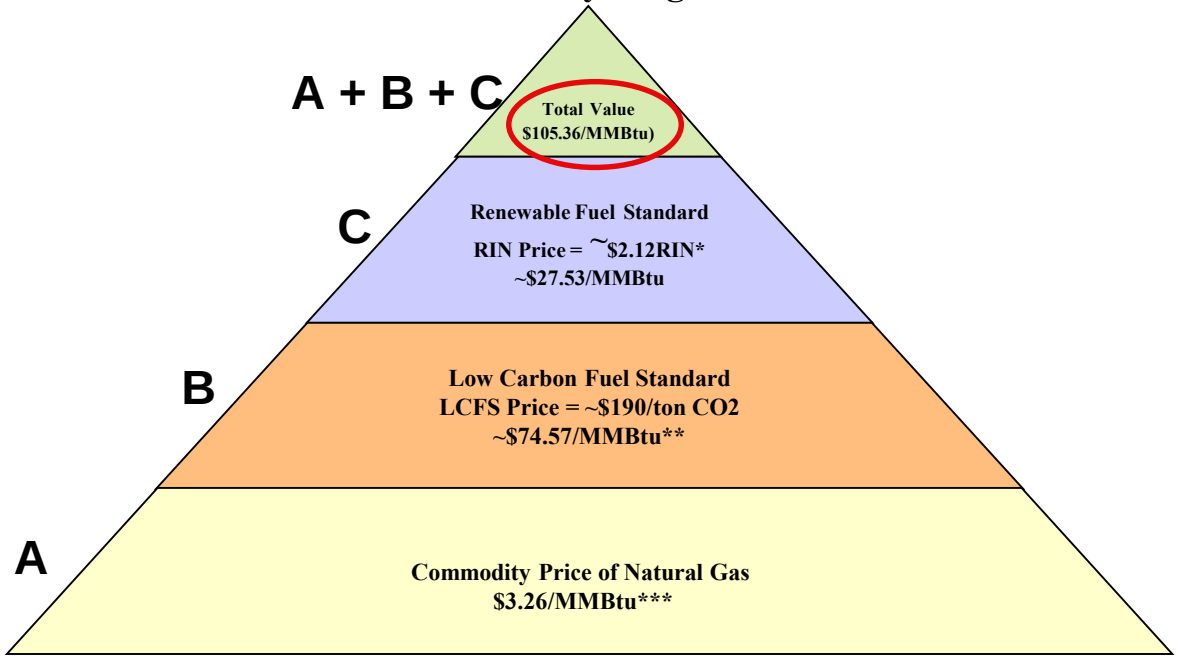
What are the Market Drivers to Produce RNG?

(Estimated Total Value of RNG When Used as a Transportation Fuel in CA)

For Dairy Biogas



Prices as of 08/03/18

* 2018 Vintage D3 RIN's

** Assumes carbon intensity for Dairy Biogas of -276 $gCO2/MJ_3$

*** Approximate Henry Hub Natural Gas Future Price – Nov 2018

http://progressivefuelslimited.com/Auth_RIN/PFL_RIN_Recap.pdf

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What are the Market Drivers to Produce RNG?

2) Utilize for Electric Generation - RNG can be used as the fuel source to produce renewable energy (utility scale and distributed generation)

- **Renewables Portfolio Standard (RPS) –** RNG can be used to help achieve California RPS goals, 50% by 2030
- **Self Generation Incentive Program (SGIP)** - California Public Utilities Commission mandated program providing incentives to support existing, new and emerging distributed energy resources

SGIP Minimum Renewable Fuel Blending	
Application Year	**% Renewable Fuel Required**
2016	**0%**
2017	**10%**
2018	**25%**
2019	**50%**
2020	**100%**

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Challenges to Produce RNG

1) **Market Price of RNG**
   - **Entities not willing to enter into long term contracts** to purchase LCFS and Renewable Fuel Standard (RFS2) due to future uncertainty of these markets

2) **Project Scale**
   - Minimum threshold is **approximately 1.0 to 1.5 million standard cubic feet per day for favorable economics** (including interconnection costs). Higher volumes generally needed for landfills
   - Small to medium scale biogas production facilities have historically not been economical. But with biomethane interconnection incentive and high credit prices things are changing

3) **Incentives/Subsidies -** Need **incentive programs specific to RNG projects** to bring down the costs

RNG Regulatory Proceedings and Legislative Bills

Biomethane: Assigned Commissioner Amended Scoping Memo and Ruling (R.13-02-008)

Overview

➢Scoping Memo issued on 7/5/18 by CPUC mostly focused on **gas quality specifications and pipeline injection standards for biomethane**

➢In accordance with Section 399.24 and with Executive Order B-48-18 issued on January 26, 2018, it is the CPUC's future intention to consider issues within this, or a successor proceeding, that pertain to **the safe, cost-effective development of other renewable gases, such as renewable hydrogen**

➢Scoping Memo states it is important to establish a standardized utility biomethane interconnection tariff and standardized interconnection pro forma forms for the use of biomethane projects across California

- Directs the utilities to jointly file a proposed standard biomethane interconnection tariff and proposed standard pro forma interconnection form

RNG Regulatory Proceedings and Legislative Bills

SB 1440 (Hueso)

Overview

- On September 23, 2018, Governor Brown signed SB 1440 which requires the Public Utilities Commission, in consultation with the State Air Resources Board, to consider adopting specific biomethane procurement targets or goals for each California gas corporation.
- At this point in time, it is not clear the process/procedure/steps the CPUC will take to “consider adopting biomethane specific targets or goals”

RNG Regulatory Proceedings and Legislative Bills

SB 1383 (Lara) – Approved by Governor 9/19/16

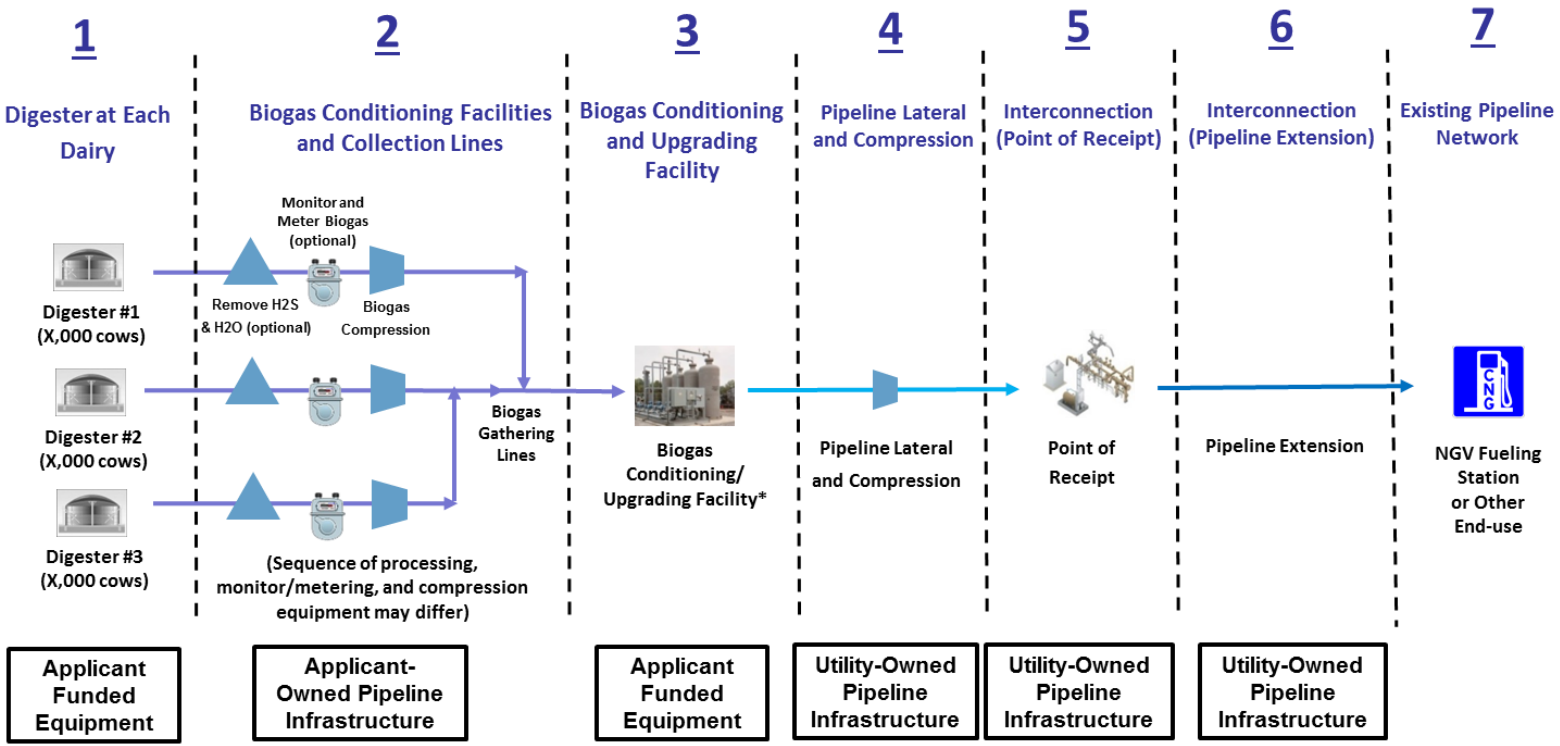
- Directs CARB to implement regulations to reduce emissions of Short Lived Climate Pollutants (SLCPs). By 2030, requires a reduction of the following compared to 2013 levels:
  - **40% reduction in methane**, 40% reduction hydrofluorocarbon (f-gases), 50% reduction in black carbon (such as diesel)

Some RNG Related Sub-Parts of SB 1383

- Methane emissions reduction goals shall include the following targets to **reduce the landfill disposal of organics**:
  - A 50-percent reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020
  - A **75-percent reduction** in the level of the statewide disposal of organic waste from the 2014 level by 2025
- Directs CARB to adopt regulations to reduce methane emissions from livestock manure management operations and dairy manure management operations by up to 40 percent below 2013 levels by 2030
  - Approximately 45% of all methane emissions in CA come from dairies, 25% from manure and 20% from enteric fermentation
  - ***No later than January 1, 2018, CPUC to direct gas corporations to implement not less than 5 dairy RNG injection pilot projects***. Reasonable **pipeline infrastructure** costs are recoverable in rates
- The state board shall **develop a pilot financial mechanism (PFM)** to reduce the economic uncertainty associated with the value of environmental credits, including credits pursuant to the Low-Carbon Fuel Standard regulations
  - ARB has published a draft SB 1383 Pilot Financial Mechanism concept paper (May 2018)
    - https://www.arb.ca.gov/cc/dairy/documents/05-23-18/pilot-financial-mechanism-white-paper.pdf

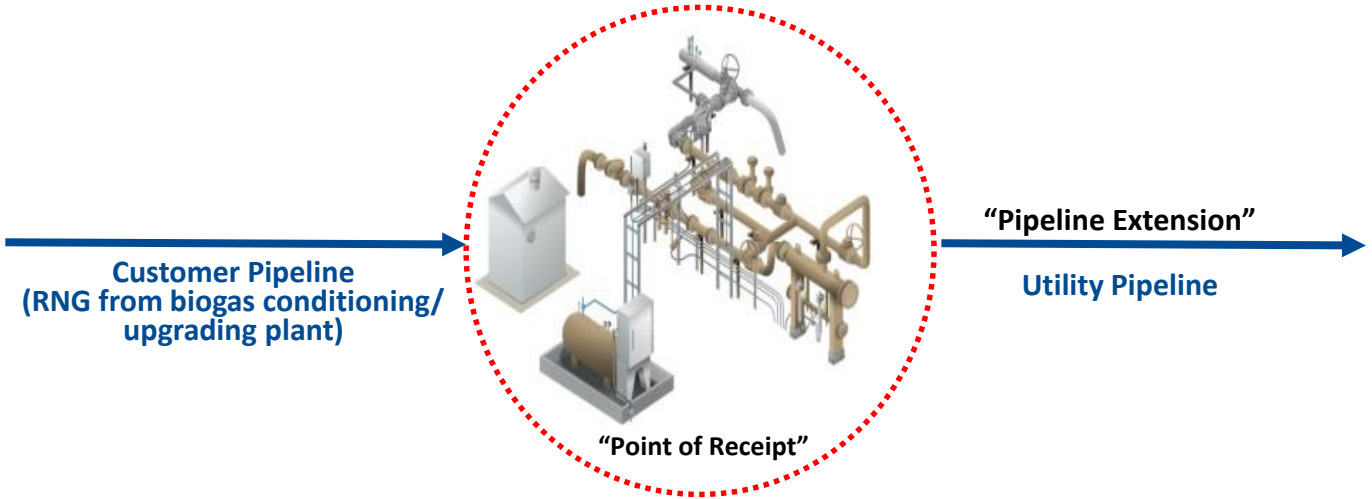
SB 1383 - Dairy RNG to Pipeline Pilot Project

Representative model



Interconnection: Overview of Components

Two Primary Components of the Term "Interconnection"



"Interconnection" = "Point of Receipt" + "Pipeline Extension"

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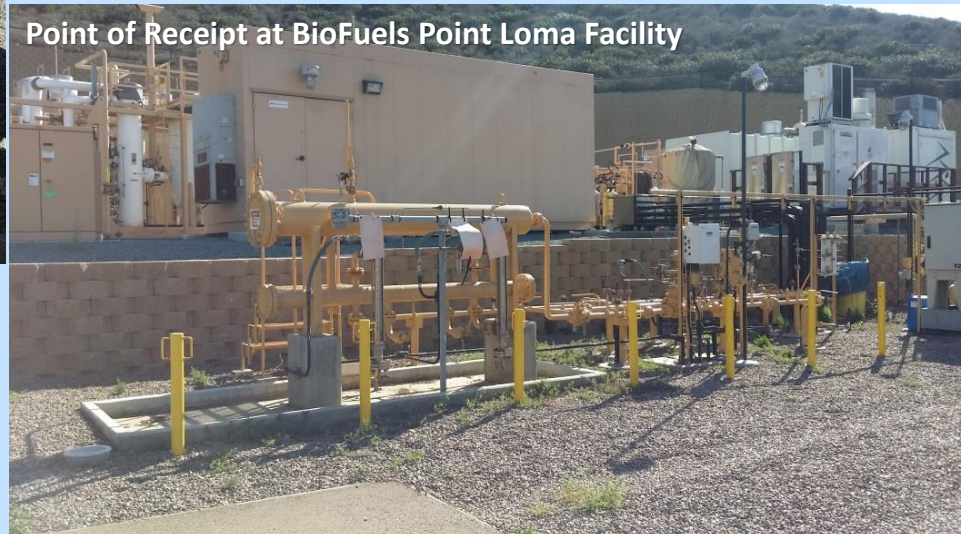
“Point of Receipt” Component of the Interconnection


Point of Receipt at CR&R Perris

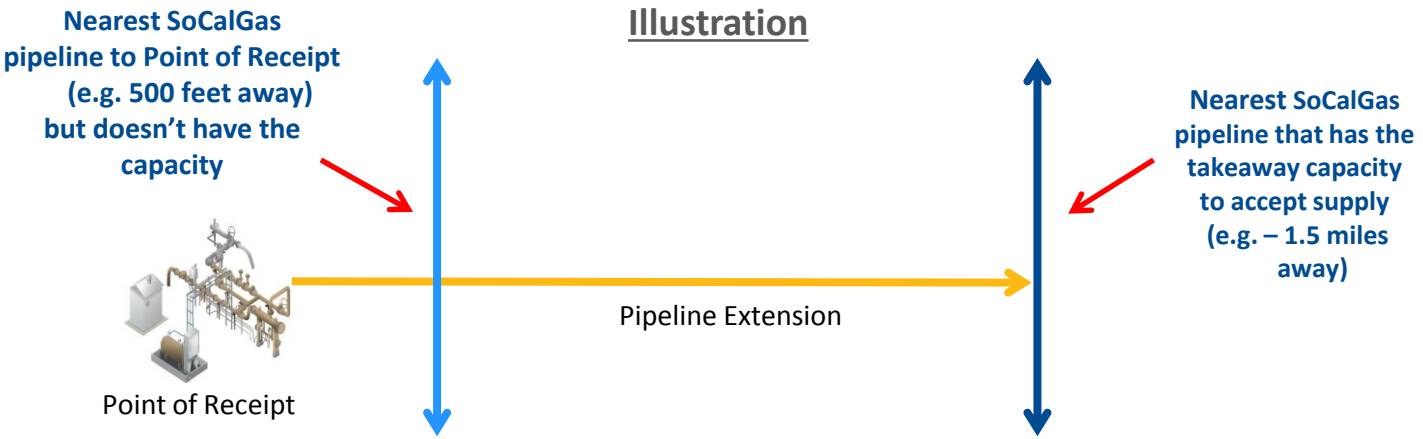
The Point of Receipt

1. **Monitors gas quality** to ensure it meets SoCalGas Rule 30 Gas Quality Specifications (e.g. CO_2, O_2, total inerts, heating value, H_2S)
2. **Prevents non-compliant gas** from entering the utility pipeline network should the monitored Rule 30 parameters not be met
3. **Meters and odorizes** the volume of RNG put into the utility pipeline network


Point of Receipt at BioFuels Point Loma Facility

“Pipeline Extension” Component of the Interconnection

- **Pipeline extension** is the pipe installed from the outlet of the Point of Receipt to the nearest utility pipeline having the capacity to accept the interconnector volume of RNG
- Majority of the pipelines in streets are **distribution lines with limited takeaway capability to accept interconnector gas** during summer months (particularly in the early a.m. hours)
  - May result in high pipeline extension costs because the nearest pipeline having the capacity is miles away



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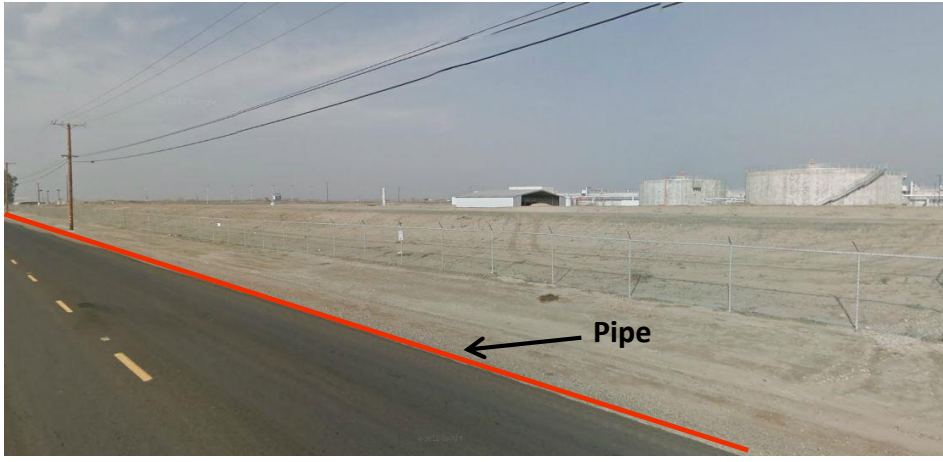
Pipeline Extension Cost Considerations

Illustration 1 (curb and gutter):

- Cost to install pipe is much more expensive when:
  - Asphalt/concrete is cut
  - Traffic control is required
  - Night work is required

Illustration 2 (no curb and gutter):

- Cost to install pipe is much less expensive when:
  - No need to cut asphalt/concrete
  - Minimal traffic control
  - No work hour restrictions



Biomethane Interconnection Incentive

Statewide Program Cap of $40 million, Ending on 12/31/21

Interconnection project with 3 or more dairies in close proximity	All other interconnection projects (e.g. landfill, wastewater, landfill diverted organics, 1-2 dairies)
Incentive of 50% of eligible costs with **$5 Million Cap**	*Incentive of 50% of eligible costs with* **$3 Million Cap**
Eligible costs include	**Eligible costs include**
Biogas collection lines	Compression equipment for product gas
Compression equipment for product gas	Utility Point of Receipt
Utility Point of Receipt	Utility Pipeline Extension
Utility Pipeline Extension	

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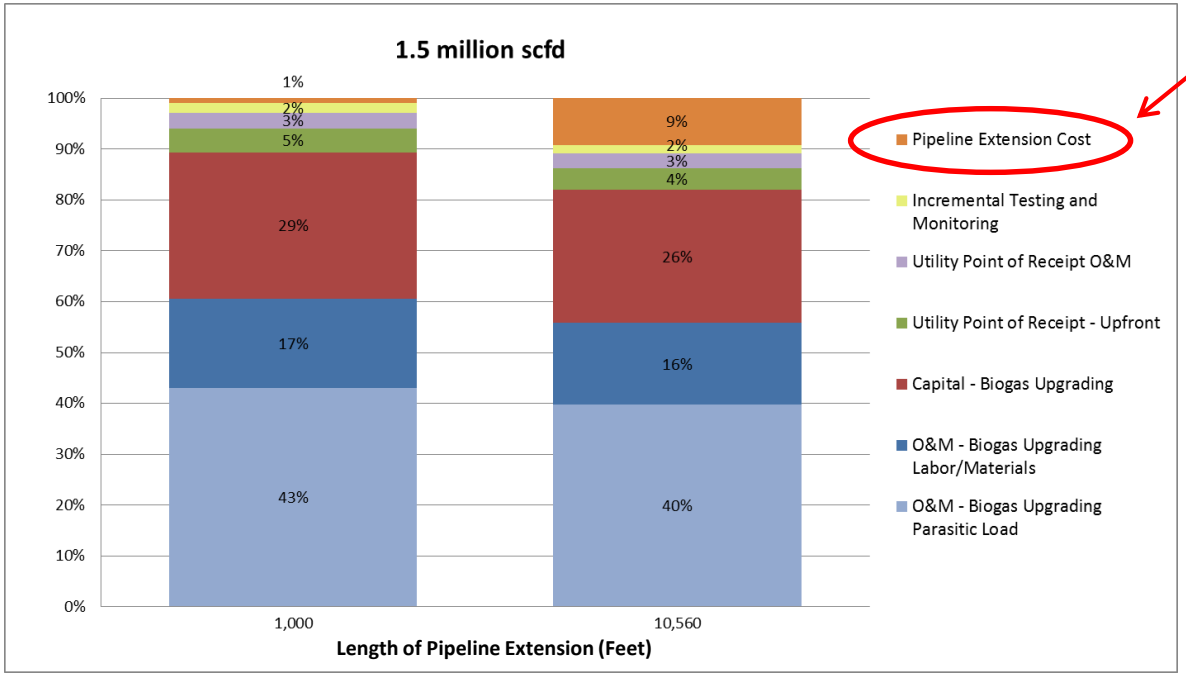
Estimated Breakdown of Major Cost Components for Producing and Injecting RNG into the Pipeline

Estimated Breakdown of Lifecycle Costs to Produce and Inject RNG into the Pipeline
{based on 1.5 million scfd of biogas for 15 years}



Location is Key!!

Breakdown includes interconnection subsidy of 50%, maximum of $3.0 million per project

1) Pipeline Extension costs are based on installing pipeline in roads with curb/gutters.
2) Estimated costs assume testing for all 17 biogas constituents and includes the cost of the tests and associated labor.

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Biogas Conditioning and Upgrading Projects

Nitrogen and Oxygen Levels in Landfill Gas Can Significantly Impact Costs and Project Economics

The removal of nitrogen (N2) and oxygen (O2) from biogas to meet pipeline quality specifications is expensive

High levels of nitrogen and oxygen exist in landfill gas because there has been little need to minimize air intrusion for a landfill gas collection system, as engines/turbines can handle these high levels

Typical Biogas Compositions by Source	Methane (CH4)	Carbon Dioxide (CO2)	Nitrogen (N2)	Oxygen (O2)
Dairy, wastewater treatment, and landfill diverted food/green waste	~60 to 65%	~30 to 35%	<1 %	<0.2%
Landfill	~35 to 60%	~30 to 40%	~10 to 30%	~1 to 3%

» In 2015, SoCalGas commissioned Black & Veatch to perform a evaluation of current biogas upgrading technologies. Included in the report is a high-level impact assessment for removing nitrogen and oxygen

Sensitivity	Scenario	Impact
Nitrogen and oxygen removal	Eliminate the need for nitrogen removal equipment	Lowers cost by 20 to 25% for large scale cases
Pipeline Interconnection Costs	Reduce (post Biomethane Interconnection Incentive) interconnection cost by 50%	3 to 10% reduction in biomethane costs. Greater impact on smaller cases