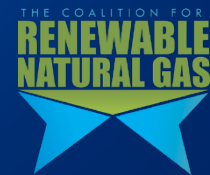




Commercial Landfill Gas Energy Projects: Opportunities & Barriers

Landfill Methane Outreach Program

March 29, 2017



Meet the Presenter

➤ Evan Williams – President of Cambrian Energy Development LLC

- Developer of 50 LFG-to-energy projects and 3 RNG Projects; co-developer of largest RNG production project in U.S. at McCommas Bluff Landfill in Dallas, Texas
- Chairman and co-founder of Coalition for Renewable Natural Gas
- Major equity holder and manager of North American Repower and its affiliated group of companies that cost-effectively convert existing medium and heavy duty diesel engines to CNG/RNG using remanufactured to like-new repowered engines.



Coalition for Renewable Natural Gas

➤ **Non-Profit Organization (501 c 6)**

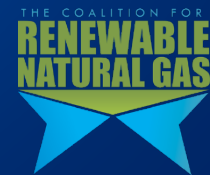
- Founded in 2011
- Membership Based
- Mission Driven
- Public Policy Focused

➤ **RNG Industry Trade Association**

- 90+ Leading Companies
- Members in US, Canada, Denmark, UK
- Represents Each Source & Sector of RNG Industry

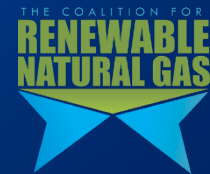
➤ **Mission:**

- Advocates for the increased development and deployment of RNG so that present and future generations will have access to this domestic, renewable, clean energy and fuel supply.



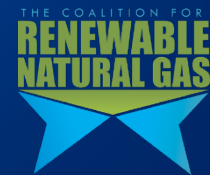
Overview

- RNG Developer's Essential Requirement – Secret Formula
- Required Engineering for Project Development
- Financing Fundamentals for RNG Projects
- High Value of RNG as Transportation Fuel
- California Impediments to Development of RNG projects
- Critical Math Lesson
- Dramatic conclusion



What is Largest Challenge to Development of an RNG Project?

- Making Money!
- For an RNG project to be successful it must meet the requirements of the Secret Formula



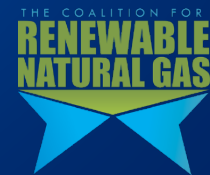
What is the Secret Formula?

- Revenues > Expenses
- Predictably



All Essential Forms of Project Engineering Must Be Completed

- Technical Engineering
- Financial Engineering
- Political Engineering



RNG Financing 101

- Debt is less costly than Equity
- RNG projects are typically financed with both equity and debt



Essentials for RNG Transportation Fuel Use Project

Transportation Fuel Market

- Access to Pipeline or other delivery method needed
- CNG/LNG Vehicles to Use RNG Fuel needed

Financing

- Available & Affordable Financing Essential
- Predictability of Term of Supporting RNG Fuel Sale Agreement must match term of debt financing
- Government guarantee of debt helps
- Tax credits help
- Grants help

Technology to Produce RNG

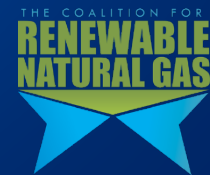
- Proven, Warrantied & Affordable Equipment to convert biogas to RNG

Economics

- Must Make Money
- Environmental Attribute Value and/or tax credit or grant support essential

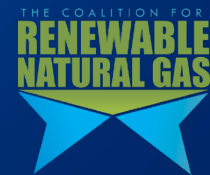
Supportive Policies

- Air permitting policies
- Land Use policies
- Economic & Financing Support policies
- Reduced Operating Expense policies

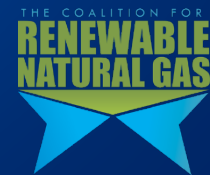


Project Finance Lenders and the Secret Formula

- **Debt payments (principal and interest) are Expenses in the Secret Formula**
- **Project Finance Lenders require minimum Debt Service Coverage Ratio**
- **Debt Service Coverage Ratio (“DSCR”)**
 - Amount of Cash Flow (Revenues – Expenses other than debt) available to meet annual interest and principal payments on debt
 - DSCR is typically a minimum of 1.2:1, but usually is higher for RNG other LFG –to-energy projects
- **Debt Service Coverage Ratio is contractual requirement to meet Secret Formula with a margin of safety to pay debt**
- **Duration of RNG Sale Agreement with creditworthy counterparty and Predictable Revenues must be at least equal to term of Debt or debt must be guaranteed by creditworthy party irrespective of term of RNG Sales Agreement**

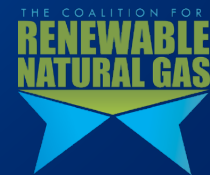


Revenues



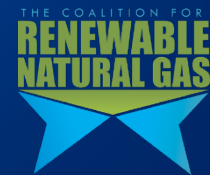
Revenues – Elements Needed

- **RNG Prices must be high enough to allow Revenues to exceed Expenses (and meet DSCR)**
- **Access to Markets**
 - Without this, there are no Revenues
- **Duration of RNG Sale Agreement at least equal to Term of Debt**



Typical Costs for LFG to Pipeline Quality RNG Project Outside California

Gas Processing Cost For 2 million Feet/Day Inlet in \$/MMBtu	
\$2.50	Plant Capital Amortization (Debt)
\$2.20	O&M for Processing Plant
\$0.38	Collection System Expansion Per Year
\$0.61	Collection System O&M Per Year
\$0.49	Initial Collection System and Flare Capital Amortization
\$0.78	Royalty to Landfill Owner
<u>\$6.18</u>	Total Cost Per MMBtu

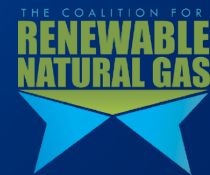


Index Price of Natural Gas

➤ Henry Hub Natural Gas Prices Quoted

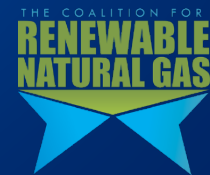
March 2, 2017 by EIA per MMBtu

– Aug 2016	\$2.82
– Sept 2016	\$2.99
– Oct 2016	\$2.98
– Nov 2016	\$2.55
– Dec 2016	\$3.59
– Jan 2017	\$3.30

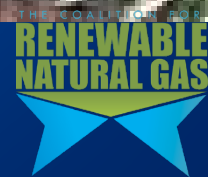


If RNG costs \$6.18/MMBtu to Produce & Natural Gas Commodity Price is <\$3.60/MMBtu, how does an RNG Producer make Money?

- **Additional Value realized from sale of environmental attributes associated with RNG**
 - It is Sold as low carbon intensity transportation fuel to meet EPA Renewable Fuel Standard 2 federal requirements and state Low Carbon Fuel Standard requirements
 - Commodity price of Natural Gas + RINS + LCFS credits
 - 11.727 RINS per MMBtu of RNG
 - D-3 RIN recent market price = \$2.50; value of RINS = \$29.32/MMBtu
- **Financial Engineering for RNG projects is more critical than Technical Engineering in achieving success**



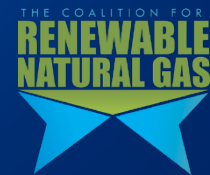
How Has California's Adoption of Mandated Diversion of Organics Out of Landfills Changed the Landfill Gas Industry in California?



Revenue Components for Different Sources of RNG as Transportation Fuel

RNG Source	Tipping Fee	Natural Gas Commodity Price	RINS	LCFS
Landfill	No	Yes	Yes	Yes
WWTP	No	Yes	Yes	Yes
Organic digester & co-digester*	Yes	Yes	Yes	Yes
Organics Gasification to Produce Syngas Upgraded to RNG*	Yes	Yes	Maybe	Maybe

* California policy to divert organics from landfills will cause shift in production of RNG from landfills to organic digesters & gasification-to-syngas-to RNG projects. More expensive disposal costs for waste will result since new infrastructure must be financed.



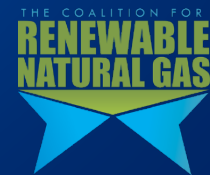
What is the Good News and Bad News About RINS and LCFS Credits?

➤ Good News

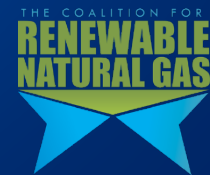
- Very high value
- A Pathway to approve RNG used to produce electric power used in electric vehicles is under consideration by the EPA

➤ Bad News

- The uncertainty as to whether the Renewable Fuel Standard will remain in effect in its current form to impose requirement for obligated parties to meet their renewable transportation fuel mandates has led to unwillingness of obligated parties to enter into long-term (i.e., longer than 5 years) agreements to purchase RINS.
 - Shorter term of agreements won't support most debt financing
- February 28, 2017 press release, which turned out to be false, that the White House had reached an agreement to shift the obligated party responsibility from the refiners to fuel blenders caused chaos in the RINs market.
- California is aware of this issue and CARB is considering changes to LCFS program to provide both higher prices and certainty of term to help support financing of RNG projects.

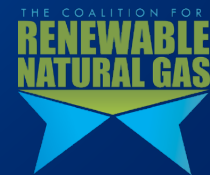


Access to Markets

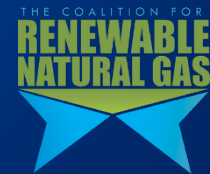


California Barriers to Natural Gas Pipeline Access

- Typically no Revenues for RNG project are realized unless RNG project is near to and can meet pipeline quality specifications for injection into natural gas pipeline
- In California, the standards for pipeline quality RNG (biomethane) now apply to all sources of RNG
 - Landfills, WWTP, anaerobic digesters, gasified organics-to-syngas-to-RNG

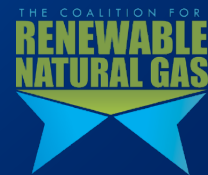


Stated Goal of California's AB 1900



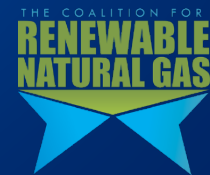
New Public Utilities Code Section 399.24

- **Promote the In-State Production and Distribution of Biomethane**
- **Facilitate the Development of a Variety of Sources of In-State Biomethane**
- **Superseded Health & Safety Code Provisions that codified the Hayden Amendment adopted in 1988**



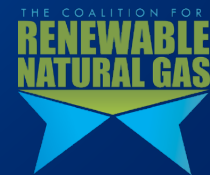
Current Regulatory Standards That Are Barriers to the In-State Production and Distribution of Biomethane (RNG)

- **990 Btus/standard cubic foot minimum heating value in southern part of state**
 - Commonly 950 Btus/scf in other states
- **Testing of large amount of Constituents**
 - Frequent and costly with opportunity for outside lab errors that could result in loss of all Revenues
- **Maximum allowable Siloxane content that approaches non-detect levels**
 - Gas processing equipment and siloxane removal equipment suppliers won't provide guarantee that their equipment will meet current California siloxane standard – hence no financing
- **Pipeline interconnection costs**
 - Range of \$1,500,000 - \$5,000,000 in California vs \$71,000 - \$1,000,000 in other states



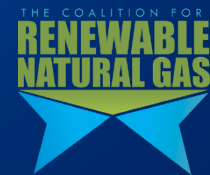
Pending Solution in California to Key Pipeline Access Issues

- **SB 840 – required study by California Council on Science and Technology of appropriate heating value and siloxanes standards for natural gas pipeline access**
- **Stanford University, one of the universities that belongs to the CCST, is undertaking that study**
- **The California Public Utilities Commission is directed to give strong consideration to the results of the study by the CCST and must adopt new regulations within 6 months following completion of such study**



Bonus Offer

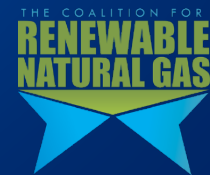
- On March 11 2016 the Coalition for Renewable Natural Gas filed with the California Public Utilities Commission a comprehensive 487 page document, including exhibits, to address existing barriers to injection of RNG into California's natural gas pipelines titled: *Revisiting AB 1900 Biomethane Pipeline Regulations to Remove Barriers Preventing Biomethane Project Development in California.*
- This document is being used as a reference by the CCST in its study
- If you provide me with a business card with your e-mail address or e-mail me with a request to receive a copy of the document, I will e-mail you a link to my Dropbox account so you may download a copy of the Coalition for Renewable Natural Gas document filed with the CPUC
- I guarantee that this document is worth the entire cost of the admission you paid to attend this LMOP Workshop!



RNG Market Needs More of These...



CNG Truck

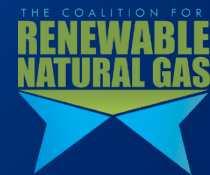


Barriers to Increase in Number of Medium Duty & Heavy Duty CNG/LNG Trucks

- **Cost**
- **New CNG truck is \$30,000 to \$100,000 more than comparable diesel truck**
- **Until diesel prices increase, fuel savings alone won't provide payback on increased price**
- **Solution: repower of existing diesel trucks to CNG with remanufactured CNG engines**
 - Total conversion costs are less than cost of new diesel truck and approximately one-third to one-half cost of new CNG truck



Predictability



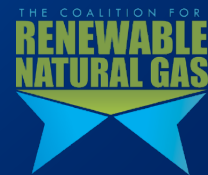
Predictability is an Issue for RNG Transportation Fuel Projects

- RNG sold for transportation fuel provides potentially higher Revenues than RNG sold to utilities to produce renewable electric power
- Uncertainty of duration of RFS2 and California LCFS programs result in obligated parties unwillingness to commit to firm pricing for purchase of RNG and value for RINS and LCFS credits beyond 2022 and for a long-term
- Short duration of RNG Sale Agreement with predictable pricing will not support needed project finance debt for RNG project



Development of RNG Projects is a Delicate Numbers Game

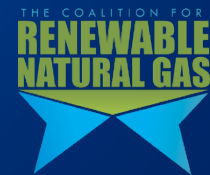
- Usually only works at larger landfills, WWTPs and anaerobic digester projects due to fixed costs of development and O&M
- Must meet Secret Formula
- Cannot engage in Fuzzy Math as to prospective financial outcome of project



What is Fuzzy Math?



Time to Rap it Up....



LFG Rap

Gimme your trash and scraps and waste
To bury 'neath my hill
Where indigenous bacteria
Will feast in my Landfill.

When feasting's done, those buggers pause
To offer up and pass
The stuff that we'll collect and treat.
It's known as Landfill Gas

It can power up our engines or
Make RNG to meet
The standards of a pipeline.
Now, Darlin', ain't that sweet?

It's a methane-rich organic fuel,
The kind we like to sell.
It's made from just the sweetest gas
A Microbe can expel.



LFG Rap

Once produced, its introduced
To an acronym-filled scene.
There's RINs and RECs and LCFS,
Scarce credits to be gleaned.

There's change afoot out West, you know,
With required organic diversion.
"Farewell" to Landfill Gas results
From this political excursion.

With rapid change a constant thing
When dealing with LFG,
We're blessed with the RNG Coalition
And the folks at LMOP.



That's a Wrap!

Thanks for Listening!!

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