

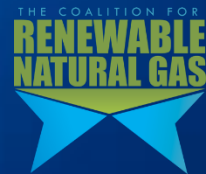
A photograph of an industrial facility, likely a natural gas processing plant. The scene is dominated by several large, vertical, cylindrical storage tanks on the left side, which are wrapped in silver insulation. A complex network of pipes, including large red pipes and smaller silver pipes, runs across the site. The pipes are supported by metal structures and feature numerous valves and fittings. In the background, there are more industrial structures, including a building with a blue roof and a white structure. The ground is paved, and the overall environment is bright and sunny, with shadows cast on the ground.

Renewable Natural Gas

Financial & Policy Hurdles for RNG Projects in California

Suggested Policy Solutions

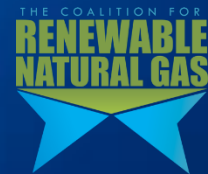
June 9, 2015



Meet the Presenter

➤ **Evan Williams – President of Cambrian Energy Development LLC**

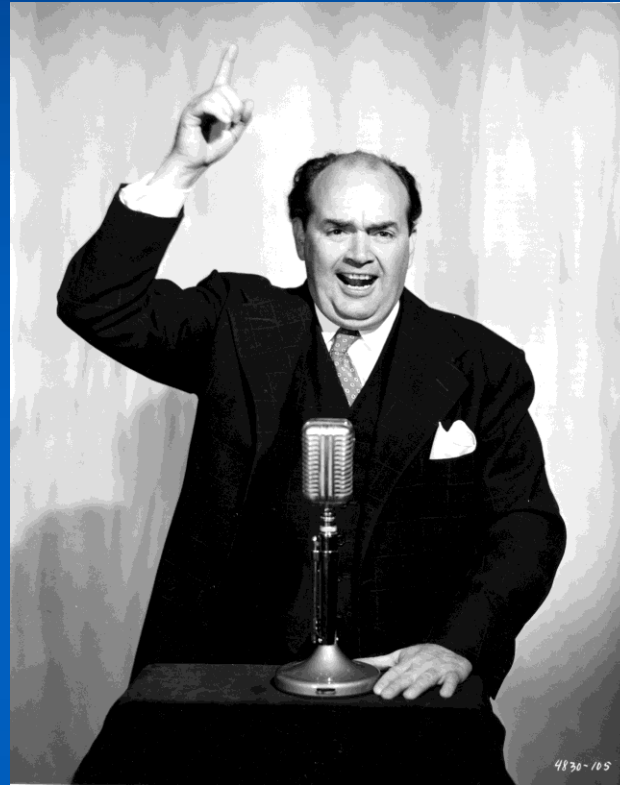
- Developer of 50 LFG-to-energy projects and 3 RNG Projects; co-developer of largest RNG production project in U.S. at McCommas Bluff Landfill in Dallas, Texas
- Chairman and co-founder of Coalition for Renewable Natural Gas



Evan's Political Qualifications



How Green Was My Valley (Best Film 1941)



**Rhys Williams – Actor
(Evan's Father)**



**Mrs. Miniver (Best Film 1942)
Walter Pidgeon & Greer Garson**



Kiss Tomorrow Goodbye (1950)

James Cagney



**The World in His Arms
(1952) Gregory Peck**



THE COALITION FOR
**RENEWABLE
NATURAL GAS**



California Political Office Qualification Standards

➤ Actor =

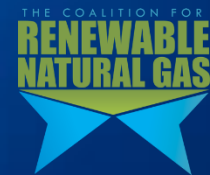
- Governor
 - Ronald Reagan
 - Arnold Schwarzenegger
- U.S. Senator
 - George Murphy



➤ Son of Actor =

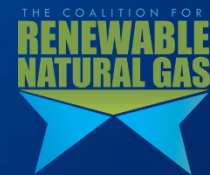
- Lieutenant Governor

Member of California Commission



Overview

- RNG Market Size – History & Number of Projects
- RNG Developer's Essential Requirement – Secret Formula
- Financing Fundamentals for RNG Projects
- Goal of AB 1900 and California Impediments to Development of RNG projects
- Potential Policy Solutions
- Needed Synchronization of State's Clean Air and Renewable Energy Policies
- Critical Math Lesson



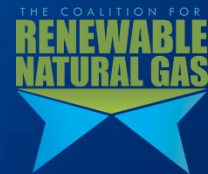
How Many RNG Projects Exist?

- LMOP Data base lists 636 total energy projects operating at landfills in U.S.
- RNG landfill projects in such total = 42
 - 6.6% of total
- California has no RNG projects on landfills
- California has 1 RNG project at a WWTP and perhaps 2 Anaerobic Digester RNG projects in development



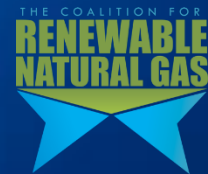
Why So Few?

- **Capital Intensive Projects**
- **Need reasonable volume of raw biogas (e.g., landfill gas) produced to justify the capital and operating expenses for an RNG processing facility**
- **Need to be located near and have right to inject into a natural gas pipeline or have other means of delivery of RNG to market**
- **Final CPUC rules governing natural gas pipeline tariffs for RNG just released**
 - Some standards, such as siloxanes, not yet finalized



What is Largest Challenge to Development of 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



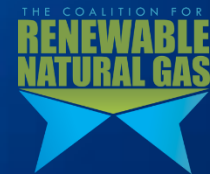
RNG Financing 101

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



Capital Structures – Equity plus Full Recourse Debt

- Debt based on asset-based, full recourse balance sheet financing and/or guarantee by creditworthy third party



Capital Structures – Equity plus Limited Recourse Project Debt

➤ Tax Exempt and/or Taxable Industrial Revenue Bonds

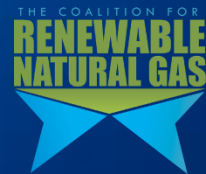
- Bonds must be investment grade to be sold to institutional investors
- May need credit enhancement through creditworthy bank letter of credit or rated guarantor
- Need underwriter for placement of bonds
- High transaction costs
 - Not cost effective for small projects



Capital Structures – Equity plus Limited Recourse Project Debt

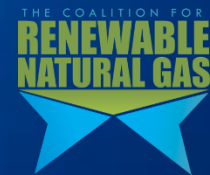
➤ Commercial bank project financing

- Tighter underwriting standards
- Less transaction costs
- Requires lender with familiarity with RNG projects
- Current climate - looks for sponsor with experience and successful track record



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**
 - 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 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**

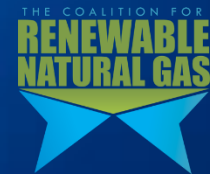


Revenues



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

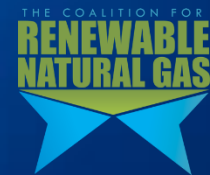
Gas Processing Cost For 2 million Feet/Day Inlet in \$/MMBtu	
\$2.50	Plant Capital Amortization (Debt)
\$2.20	O&M for Processing Plant
\$0.38	Collection System Expansion Per Year
\$0.61	Collection System O&M Per Year
\$0.49	Initial Collection System and Flare Capital Amortization
\$0.78	Royalty to Landfill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



Index Price of Natural Gas

➤ NYMEX Natural Gas Futures Prices Quoted February 21, 2015 per MMBtu

– May 2015	\$2.91
– Nov 2015	\$3.11
– Dec 2015	\$3.27
– Jan 2016	\$3.43
– Feb 2016	\$3.41
– Apr 2016	\$3.15



If RNG costs \$6.18/MMBtu to Produce & Natural Gas Commodity Price is <\$4.00/MMBtu, how does an RNG Producer make Money?

➤ Additional Value realized from sale of environmental attributes associated with RNG

- Sold to utilities to produce renewable electric power to meet Renewable Portfolio Standard requirements
 - Commodity price of Natural Gas + Value of RECs translated in to sales price of RNG + Value of any Avoided California Cap and Trade emission offset credits
- 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

➤ Financial Engineering for RNG projects is more critical than Technical Engineering in achieving success

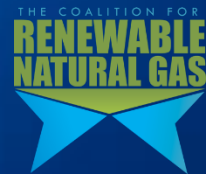


Access to Markets

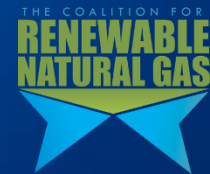


Natural Gas Pipeline Access

- Typically no Revenues for RNG projects realized unless RNG project is near to and can meet pipeline quality specifications for injection into natural gas pipeline
- Standards for pipeline quality RNG (biomethane) apply to all sources of RNG
 - Landfills, WWTP, anaerobic digesters

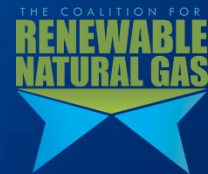


Stated Goal of AB 1900



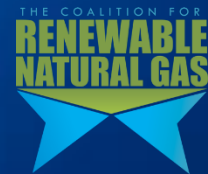
New Public Utilities Code Section 399.24

- **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**



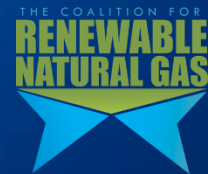
Those Who Do Not Learn from History are Condemned to Repeat It

A History Lesson



Origins of the 1988 Hayden Amendment

- Well intended.....but regulated the wrong phenomenon with unintended consequences
- Pertained to presence of vinyl chloride, a carcinogen, in pipeline gas; criminal penalties and fines imposed for violation on both producer and pipeline company
- Led to prohibitions in Rule 30 and Rule 21 tariffs of California's natural gas pipeline companies from accepting landfill gas-derived Renewable Natural Gas
- What were the facts?



Hayden Amendment (Calif. Health & Safety Code Sections 25420 & 25421) Factual Circumstances



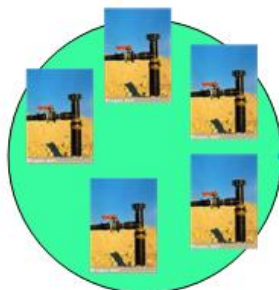
Operating Industries, Inc. Class I Hazardous Waste Landfill in Southern California that accepted chlorinated solvents and other liquids and solid waste hazardous materials. Became Superfund Site due to bad landfill management practices.



Southern California Gas Company Natural Gas Pipeline Interconnected to GSF RNG Processing Facility

Gas Chromatograph with continuous measurement of RNG chemical constituents to assure compliance with pipeline specifications

Processed RNG meeting So. Calif. Gas Co. natural gas pipeline specifications



Collected LFG delivered to gas processing facility



GSF gas processing facility using advanced oil & gas industry processing technology that removes trace contaminants and CO2 from collected LFG to meet natural gas pipeline quality standards of So. Calif Gas Co.

LFG Wells installed only in center portion of Oil Landfill to collect LFG for processing to pipeline quality RNG.

No LFG Wells Installed

No LFG Wells Installed

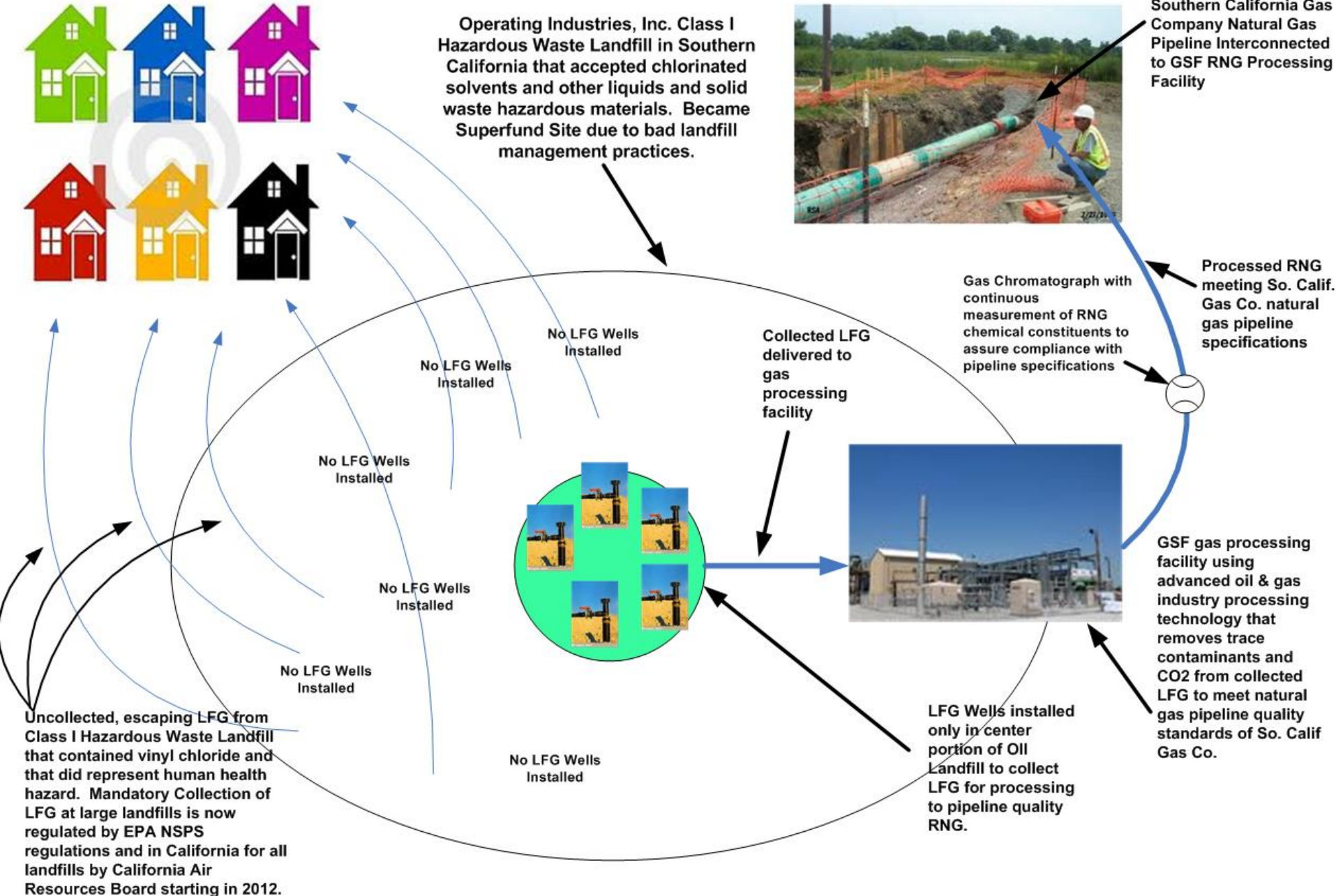
No LFG Wells Installed

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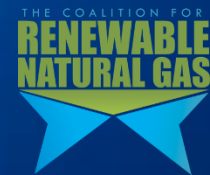
No LFG Wells Installed

Uncollected, escaping LFG from Class I Hazardous Waste Landfill that contained vinyl chloride and that did represent human health hazard. Mandatory Collection of LFG at large landfills is now regulated by EPA NSPS regulations and in California for all landfills by California Air Resources Board starting in 2012.



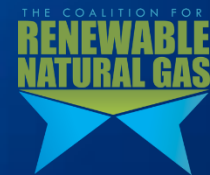
Source of Vinyl Chloride in LFG

- 1987 Report by Battelle, Pacific Northwest Laboratories commissioned by California Air Resources Board : “Study of Vinyl Chloride Formation at Landfill Sites in California”
- Conclusion: “These experiments clearly show that microbial action on chlorinated solvents in landfills is the most probable source of VC [vinyl chloride] formation in situ.”
- Chlorinated Solvents could only be disposed of legally in a hazardous waste landfill
- Hayden amendment imposed criminal penalties and applied regulation to all landfills



Current Regulatory Standards That Could be Improved to Promote the In-State Production and Distribution of Biomethane (RNG)

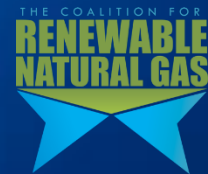
- **990 Btus/standard cubic foot minimum heating value**
 - Commonly 950 Btus/scf in other states
- **Testing of large amount of Constituents**
 - Frequent and costly with opportunity for outside lab errors that could result in loss of all Revenues
- **Maximum allowable Siloxane content that approaches non-detect levels**
 - Recent lab test of natural gas in California pipeline show natural gas in pipeline failed proposed siloxanes standard
 - GTI 2012 RNG Report states no siloxanes in natural gas
 - So....lab error or some siloxanes in California natural gas?
- **Pipeline interconnection costs**
 - Range of \$1,500,000 - \$3,000,000 in California vs \$71,000 - \$282,000 in other states



Recommended Policy Change to Pipeline Minimum Heating Value Specification for RNG

➤ When circumstances leading to adoption of Regulation or Law change, shouldn't the Regulation or Law also change?

- Sempra Rule 30 has minimum heating value specification of 990 Btus/scf and maximum of 1,150 Btus/scf
 - Adopted when concerns about imported LNG arose
 - With abundance of domestic natural gas, no LNG imports foreseen
- Prior heating value specification for California natural gas producers was 970 Btus/scf



Recommended Policy Change to Pipeline

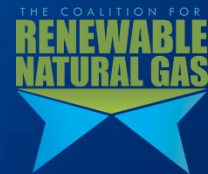
Minimum Heating Value Specification for RNG

- **Total volume of all RNG that could be produced in California is “spit in the ocean” when compared to volume of natural gas in California pipelines**
- **Proposed Heating Value Standard applicable to California-produced RNG:**
 - 950 Btus/scf
 - If volume of RNG is greater than 25% of volume of natural gas in pipeline into which it is injected, then minimum heating value would be 970 Btus/scf
 - Recognizes that RNG does not have higher chain hydrocarbons as does natural gas, and thus has inherent lower heating value
- **Recommended heating value standard is consistent with objective of AB 1900 and doesn't affect balance of pipeline tariff heating value standard for other sources of gas**
 - RNG would be very small percentage of gas in pipeline (blended dilution)
 - Gives recognition to inherent difference between fossil natural gas and RNG



Constituents Tested

- **Most states test for 6 or 7 constituents in gas**
- **California tests for 17**
 - 12 specified by CARB and OEHAA under health and safety analysis
 - 5 requested by natural gas utilities for system integrity and adopted by CPUC
- **Testing for many constituents listed must be done by outside laboratory**
 - Expensive with variability in results
- **California standards assume NO DILUTION of RNG in pipeline**
 - Assumption, in essence, is natural gas pipeline into which RNG is injected will be empty before injection



Siloxane Constituent

- Siloxane not a constituent normally included in natural gas pipeline tariffs
- Siloxane has not been reported as an operational issue created by RNG produced and injected into pipelines in 35 year history of RNG industry
- CPUC Decision 14-01-034 issued for comments on Jan 16, 2014 established following levels for siloxanes in RNG:

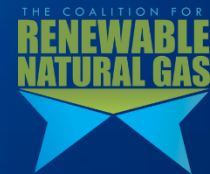
Trigger Level	Lower Action Level	Upper Action Level
0.01 mg Si/m ³	0.1 mg Si/m ³	?



Siloxane Constituent

➤ Testing (for all constituents)

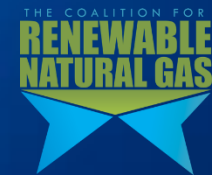
- Start-up Testing – 2 to 4 weeks
 - Must demonstrate RNG is below Lower Action Level to get into pipeline
- Below Trigger Level must do Annual Testing
- Below Lower Action Level Must do Quarterly Testing
- RNG is shut out of pipeline (loss of all Revenues) if
 - 3 exceedances in 12 month period above Lower Action Level
 - 1 exceedance above Upper Action Level



Recommended Policy Change for Siloxane Constituent

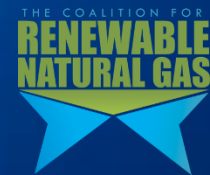
- **Apply dilution factor of 3 times (i.e., RNG would be slightly less than 1/3 of gas in natural gas pipeline**
 - Siloxanes are not a health & safety concern
- **New levels would still be below siloxanes specification for IC engine manufacturers**
- **Reduces risk to RNG project that entire revenue stream will be lost due to lab test variances**
- **New standard recommended**

Trigger Level	Lower Action Level	Upper Action Level
0.03 mg Si/m ³	0.3 mg Si/m ³	3x ?



Recommended Policy Change for High Pipeline Interconnection Costs

- Include in rate base of natural gas pipeline
- CPUC Decision allows 50% of interconnection costs to be paid up to maximum of **\$1,500,000 per project**
 - Maximum of \$40,000,000 for all RNG projects

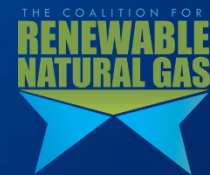


Predictability



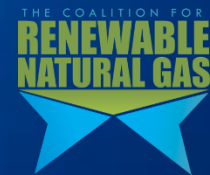
Predictability an Issue for RNG Transportation Fuel Projects

- 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
- Short duration of RNG Sale Agreement with predictable pricing will not support needed project finance debt for RNG project



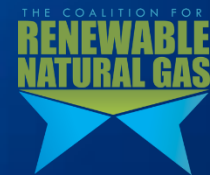
Recommended Solution to Financing of RNG Projects for Transportation Fuel

- **California state agency guarantee of 90% of RNG project asset-secured debt (whether bonds or commercial debt) with term of 15 years (including up to 2 years of construction and 13 year amortization) used to finance up to 80% of capital expenditures and related debt costs for RNG project**
 - Balance of Capital Expenditures financed by equity
- **Require projected Debt Service Coverage Ratio of 1.2:1**



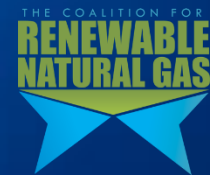
Recommended Solution to Financing of RNG Projects for Transportation Fuel

- **Solution solves predictability issue with respect to needed debt for RNG for transportation fuel**
- **State credit made available to RNG project without immediate, or perhaps any, use of tax dollars**
 - Similar debt guarantee program already exists for conversion of diesel vehicles owned by small fleets to alternative fuels
- **Obligated parties under LCFS probably willing to enter into 15 year RNG Purchase Agreement with formula for pricing RINS and LCFS credits (as opposed to fixed price) and with “regulatory out” as to RINS if RFS2 program terminates and as to LCFS credits if LCFS program in California terminates**
- **Loan guarantee would support RNG projects that would meet California objectives of getting diesel vehicles off roads and adoption of alternative fuel vehicles, such as CNG/LNG**
 - RNG is lowest carbon intensity transportation fuel available



Need to Remove Eligibility Requirements and Penalty in Cap and Trade Regulations for RNG Projects

- **Background: Before October 2011 RNG was regarded as a zero emission fuel by DOE and California Climate Action Registry**
- **October 2011 – CARB adopts final Cap and Trade and Greenhouse Gas Mandatory Reporting Regulations in which RNG (a biomass-derived fuel) only is given zero emission eligibility if it is sold pursuant to contract entered into prior to January 1, 2012 or from incremental production or doesn't involve “contract switching”**
 - CARB intent – only want to provide incentives to “new” production from only RNG projects that then existed, i.e. out-of-state
 - In 2011, AB 1900 had not been adopted and there were no in-state RNG projects from landfills and only 1 in development at WWTP
 - Observation: Cap and Trade should deal with CO2 emissions avoided by nature of RNG and not when it was contracted for sale or whether it was from incremental production
- **In 2012 AB 2196 was adopted concurrently with AB 1900, and it, in effect, prohibited out-of-state RNG being used in California by utilities to produce renewable electric power to meet RPS**



Need to Remove Eligibility Requirements and Penalty in Cap and Trade Regulations for RNG Projects

- **Impact on California Projects:** CARB regulations for IC engines on large landfills are causing shut-downs of projects due to expense of emission treatment to comply
- RNG produced from landfill gas from large IC engine projects will not be regarded as incremental production under CARB Cap and Trade Regulations, thus not zero emission
- RNG projects have extremely low on-site emission profile
- Obligated party purchasers of such RNG will be required to purchase offset credits with respect to emissions produced using such RNG
- Cost of such emission credits will be deducted from sale price of RNG purchased – HUGE PENALTY, estimated at \$1 to \$2/MMBtu
- Eligibility requirements for zero emission treatment of RNG in Section 95852.1.1 of Cap and Trade regulations were targeted at out-of-state RNG projects, which no longer can sell RNG into California for RPS purposes.
- Result: Cap and Trade RNG eligibility requirements penalize in-state RNG projects at large, former on-site electric power projects contrary to intent of AB 1900.
- Recommendation: delete RNG eligibility requirements from Cap and Trade Regulations



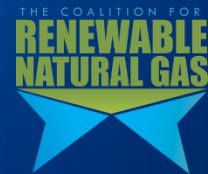
Policy Solutions to Encourage RNG Production in California

- A full menu of policies that could be adopted to encourage RNG production in California was prepared by the Coalition for Renewable Natural Gas and presented at a Workshop of the California Energy Commission in 2013 in connection with the CEC Biennial Energy Plan
- A Copy of that presentation is available from the Speaker upon request



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?



Thanks for Listening!!

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