



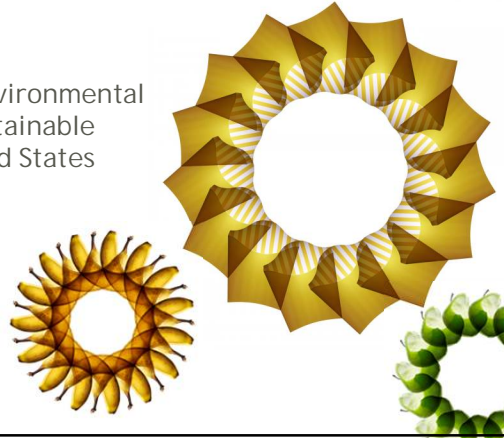
WASTE MANAGEMENT

California Barriers to the Development of RNG as a Transportation Fuel

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Technological, Economic and Environmental Potential of Natural Gas as a Sustainable Transportation Fuel in the United States
October 1, 2015 – UC Davis

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Greening WM's Fleet

Waste Management's Natural Gas Fleet Evolution



Investment in NGV is a Strategy with one of the Highest Rates of Return of any investments in WM's portfolio



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Davis, CA

WM Fleet Facts

- WM's Fleet Goal: Reduce emissions & increase fuel efficiency by 15% by 2020
 - GHGs already down 18%
- WM has 38,400 Vehicles
 - 20,400 Collection HDVs
 - 18,000 MD & LD support & HD post collection transfer vehicles
- Over 3,200 NG HDVs – 50% are in California
 - Goal: All CA NGVs will be fueled by Renewable NG – near zero GHGs
- 61 natural gas stations built in 27 states, 2 provinces
 - 10 public fueling stations + 12 others with 3rd party use
- 90% of new truck purchases are natural gas – Mostly CNG
 - On line to purchase 700+ natural gas trucks per year nationwide



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Alternative Transportation Fuel Technologies

Recovery of Energy Products via Emerging Processes

- BioGas converted to ultra-low carbon low-carbon fuel for CNG/LNG trucks



- BioGas to electricity sent to grid from which fleets power electric vehicles can qualify for cellulosic RINS and LCFS credit



- BioGas to Diesel technology can produce advanced or cellulosic biofuels



 Enerkem

- Commercial-scale facility 400-500 tpd
- Gasification of **biogenic** MSW and biomass to ethanol & syngas



- MSW to ethanol via large-scale plasma gasification
- Commercial-scale facility 400-500 tpd

 Fulcrum
BIOENERGY



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Developing Renewable Natural Gas from the Wastes WM manages should be a No-Brainer – Right?

Yes, But . . .



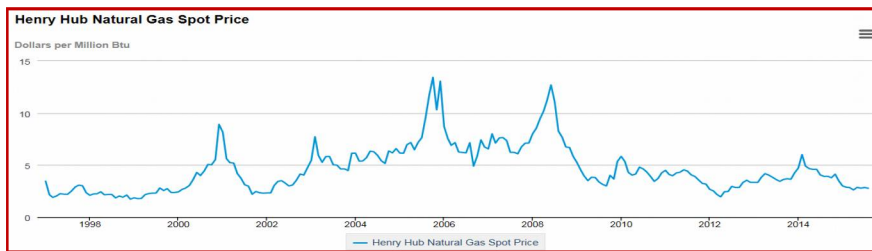
There are LIONS and TIGERS and BEARS (and WITCHES) to overcome: –



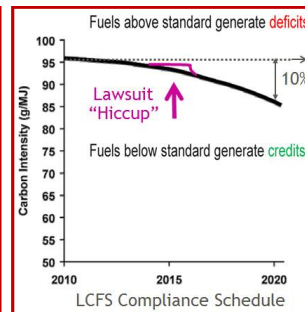
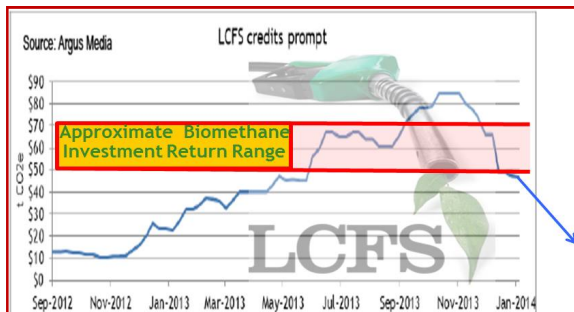
Chuck's Top Ten Witches:



1. Historic Low Price of Fossil Natural Gas



2. Uncertainty of LCFS and RFS2 Credit Value



3. Inability to Secure Long Term LCFS/RFS2 Credit Contracts

Obligated Parties have been Unwilling to Enter into Long-Term Contracts for the Values of the LCFS/RFS2 Credits



4. Mixed Messages from Natural Gas Utilities

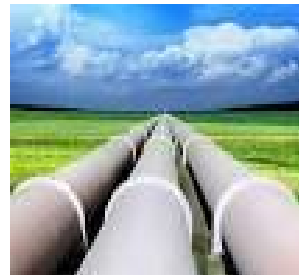
- Utilities pushed for stringent RNG standards
- But, some Utilities do offer conditioning service
- Some Utilities recognize that lowering the Carbon Intensity of pipeline gas is “coming”.



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Making California Pipeline Biogas Work

- AB 1900 (Gatto) Signed in 2012
 - AB 2196 (Chesbro) Also Enacted
 - Limits ability of Out-of-State Biomethane for RPS
- Allows for Pipeline Injection and Transportation of Biomethane
 - Including Landfill Gas
- Directs CPUC to Develop Standards: 1) Human Health & Safety + 2) Pipeline & Pipeline Facility Safety & Integrity
- CPUC Phase I Proceeding Set Standards 2013; Phase II Proceeding Allocates Costs 2015
- Also CPUC proceeding for use of NG GHG C&T Revenues



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5. Pipeline Access Standards for RNG Difficult

- CPUC Standards are Toughest in US
 - 990 BTU/scf – 98% pure methane
 - Siloxane thresholds not measurable
- No evaluation of fossil NG
- Only 1 RNG to Pipeline in CA Multiple
- Out-of-State projects (LCFS pathways)
- Utilities are Offering Conditioning Service

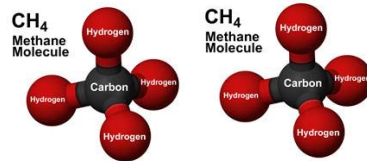


6. Pipeline Interconnection Costs **\$\$\$ \$\$\$\$ \$\$\$\$**

- Pipelines not always near where RNG is Produced
 - ❖ Interconnection Cost: \$3 million or more
 - ❖ Recent CPUC decision helps: up to \$1.5 million
 - ❖ Should Utilities be obligated to cover interconnection costs as a public GHG good?

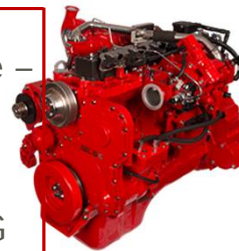
7. Short Lived Climate Pollutants (SLCPs)

- What Controls will CARB adopt for Methane?
- Will LCA's be required?



8. Regulatory Preference for Zero Emission Vehicles (Electricity and Hydrogen)

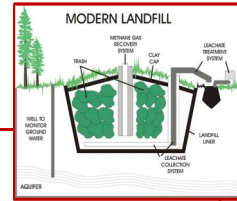
- But – Cummins/Westport -- Near Zero NOx Emissions ISL-G Natural Gas Engine – 0.02 gNOx/bhp-hr
 - 9 liter now, 12 liter soon
 - Same or lower than ZEV
 - Transition Fuel to near zero GHG RNG





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9. Landfills are Cost Effective Source of RNG – But Not Preferred



- Fugitive Methane Emissions Concerns
- Organic Waste to AD units Preferred
- But, LFs produce methane more than 30 years
- AD won't produce significant RNG for 15 yrs

10. Need to Think Outside of Boxes



- Agencies in Silos (Air, Energy, GHGs, NOx, Waste)
- Example: SCAQMD Rule 1110.2 on Biogas Engines
 - NOx limits aren't cost-effective
 - Back to Flaring ?
 - Gas to Pipeline Better at limiting Emissions



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Thank You -- Any Questions?



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