SoCal – Energy Vision RNG Workshop
October 27, 2016
Dairy Biogas Perspective
Neil Black
About California Bioenergy LLC ("CalBio")

- Founded 2006, focused on dairy biogas in California
- Design, finance, build, own and operate projects
- Partner with dairy farmer
- Digester technology neutral: lagoon, tank, cement systems reflect site conditions
- Expertise across disciplines
  - Electricity, gas pipeline and fuel (RNG and H) generation
  - Project finance, construction, environment, policy
  - Project operations and maintenance, 24 x 7 uptime focus
  - Dairy waste-management and nutrient-handling systems
California Dairy Industry Key Statistics

- Produce 20% of America’s milk
- Largest ag industry in CA
- 1.8M milk cows, 1,400 dairies
- Dairy methane potential:
  - 350 MW base load (850 MW peaking)
  - 180M diesel gallon equivalents of fuel
- 50% of CA methane emissions, half of that from manure lagoons
- ARB-SB 1383: 40% reduction x 2030
  1. Only 16 active + 3 in construction
  2. No commercial RNG, biomethane
Dairy GHGs are Cost Effective*

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<td>Enhanced fleet modernization program “plus-up”</td>
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<td>Truck and bus voucher incentives</td>
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<td>Incentives for public fleets pilot project for DACs</td>
<td>725</td>
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<td><strong>Overall Average</strong></td>
<td><strong>$57</strong></td>
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* Based on 100 yr GWP
Electricity versus Fuel

**Electricity**
1. Stable, long-term contracts with a utility
2. Operational experience

**Fuel**
1. NOx reductions
2. Potential for higher value – LCFS and RIN credits

**Problem:** NOx emissions

**Problem:** Credit uncertainty
“Meeting these new standards* requires a virtual ban on fossil-fuel combustion or emissions”

Dairy Biomethane for Fuel Reduces NOx

* Heavy-duty diesel engine at 0.2 g/bhp-hr NOx.  Heavy-duty “NZ” NG engine at 0.02 g/bhp-hr NOx.  Electric gen. at 0.15 g/bhp-hr BACT
Dairy Biomethane Fuel Carbon Intensity

* California Bioenergy LLC: California Dairy Digester Biogas to CNG GREET 2.0, LCFS FP: CNG056, CI: -276.24
Kern Co Dairy Cluster - Action Center

- **Finalist – Sustainable Freight Action Plan**
- **15 modern, large dairies**
- **1 built digester; 2 in construction**
- **Pioneer – combine electricity and fuel**
- **Methane potential:**
  - 12 MW base load (30 MW peaking)
  - 5M diesel gallon equivalents
Cluster Map

California Bioenergy Dairy and Pipeline Map

Legend
- Dairy Outline
- CNG Truck Station Site
- City Boundary
- Parcels
- Bio-Gas Pipeline - No R/W (15.26 ft)
- Bio-Gas Pipeline in R/W (9.15 ft)
- SoCal Gas - 2000psi Linc (Approx)
- PG&E Gas Line
- Roads

1 inch = 1 mile
CE&S Dairy

The project is located across the road from the Old River Dairy in the Kern County cluster. Demonstration facility utilizing waste heat from the engines to cool milk and advance project economics. Will serve as a spoke for R-CNG

QUICK FACTS

- 1 MW of community scale, renewable electricity capacity, off-setting dairy load
- Generation of ~6-7,000 MWh per year
- Waste heat harnessed through an absorption chiller to cool milk
- Planned future phase contribution to R-CNG transportation fuel
Separator, sand lane, octagon, digester
Separator and flat digester
Double-lined digester
Inflated digester
The source and covered lagoon
CalBio Contact Information

Neil Black (President)
nblack@calbioenergy.com
cell: 917-589-6009

Ross Buckenham (CEO)
rbuckenham@calbioenergy.com
cell: 214-906-9359

John Bidart (co-founder)
john@bidartdairy.com

www.calbioenergy.com