Control Technologies for Use of Digester Gas

For Climate Action Reserve Webinar – A Path Forward for Dairy Digesters in California
March 15, 2011

Ramon Norman
Air Quality Engineer
San Joaquin Valley Air Pollution Control District
San Joaquin Valley
- Hot, sunny summers
  - VOC, NOx
  - Ozone Problem
- Cool, foggy winters
  - Particulate problem
Federal & State Air Quality Regulations

- Federal Clean Air Act Requires District to achieve clean air, or
  - Huge fees on local industry
  - Loss of Federal highway funds
  - Feds take over local air program
- Federal and State regulations require Best Available Control Technology (BACT) for new or modified equipment to minimize emissions
- 2007 Extreme Ozone Plan
  - Requires every feasible VOC and NOx reduction
  - Achieves clean air in 2023 only with reliance on “black box” of unknown technology
Advantages of Use of Biogas

• Reductions in greenhouse gas emissions needed for AB32
• Increased renewable energy to meet California’s goals of attaining 33% of its energy from renewable sources by 2020
• Potential for VOC and odor reductions from waste storage.
• CEQA
Challenges Related to the Use of Biogas

• Increased NOx emissions compared to combustion of natural gas
• Contaminants hinder the use of emission controls
  – Water Vapor
  – H2S can be very high depending on digester substrate
Internal Combustion Engines

- As low as 35-50 ppm NOx (best lean-burn engines, without external pollution controls)
- Engine controls
  - Three-way catalysts on rich-burn engines
  - Selective Catalytic Reduction (SCR) lean-burn engines
  - NOxTech for large lean burn engines
  - Hydrogen Injection
Gallo Cattle Company Digester Gas-Fired Engine with 3-Way Catalyst
Fiscalini Farms Dairy Digester Gas-Fired Engine with SCR
Other Low-Emission Combustion Technologies

- **Microturbines** – very low NOx, but more demonstrations needed
- **Gas Turbines** (For very large projects > 2.5 MW)
- **Boilers/Steam Generators**
- **External Combustion Engines** (Currently Being Developed)
Four 30 kW Capstone Microturbines at Top Deck Holsteins Dairy in IA
Other Air Friendly Technologies

- **Fuel Cells**
  - Near-zero emissions, super efficient
  - Proven technology, but costly
  - Large incentives available for installation (but are incentives enough? – no dairy proposals, yet)

- **Gas Pipeline Injection**
  - Avoids NOx emissions associated with combustion
  - Limited availability (must be close to pipeline)
  - One installation in operation in the Valley

- **Compressed Methane as Vehicle Fuel**
  - No need to be near a pipeline
  - Replaces combustion of diesel fuel
Hilarides Dairy Bio-methane Powered Milk Trucks
Current Farm Biogas Demonstration Projects in the San Joaquin Valley

- Rich Burn Engine with three-way Catalyst
- Lean Burn Engine with SCR
- Permits Issued for Greenguard (Virtual lean burn) engines with NSCR
- Permit Recently Issued for Ultra Lean Engine with Hydrogen Injection

- The District looks forward to facilitating more innovative proposals for project that will increase renewable energy while meeting the Valley’s Air Quality needs
How We are Moving Forward

• The San Joaquin Valley Air District encourages win-win solutions that will increase renewable energy production in the Valley while meeting the Valley’s Air Quality needs
  – Encourages no-NOx and low-NOx innovation:
    • Advanced engine controls
    • Gas pipeline injection, fuel cells, compressed methane
    • Examine Feasibility of Central Power Plants for Multiple Facilities grouped together
  – Allow flexible permits – use controls but BACT limit can be increased if it cannot be achieved
  – Working together with other agencies to find ways to fund or partially fund promising low-NOx proposals
Air District Contacts

(559) 230-6000

Permitting issues:
• Dave Warner, Director of Permit Services
• Ramon Norman, Air Quality Engineer

Grants, funding issues:
• Samir Sheikh, Director of Strategies & Incentives
• Kevin Wing, Air Quality Grants Specialist