



Plugging Dairies into a Renewable Future.

12-3-15 EPIC Symposium Presentation

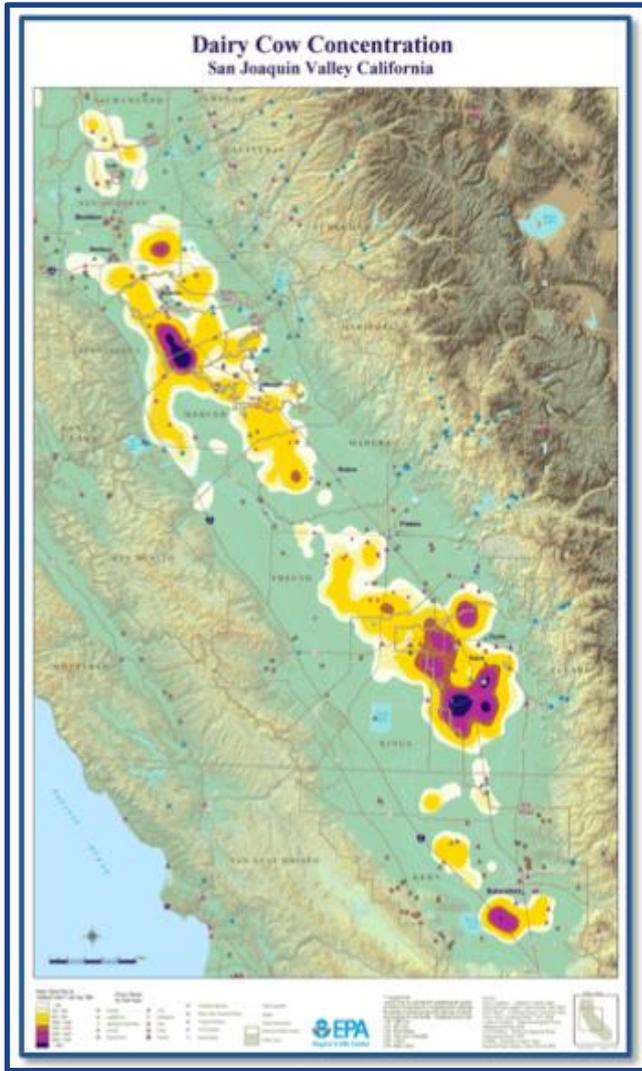
*CE&S Dairy Biogas (PON 14-307)*

Addressing:

CH<sub>4</sub> destruction, CHP innovations,  
Financial advances and NO<sub>x</sub> reductions



# California Dairy Industry Key Statistics



- Largest dairy industry in America, 20% of nation's milk
- 1.8M milking cows on 1,500 dairies, concentrated in the Central Valley
- Source of approximately 50% of California's methane emissions
- ***Dairy manure management responsible for 25% or 7M to 9M metric tons CO<sub>2</sub>e per year.***
- Potential 350 MW baseload 700 MW of storage and co-benefits



# Address State Goals to Advance Industry



- **AB 350 goal:**
    - 50% electricity generation from renewable sources
  - **ARB's lagoon CH<sub>4</sub>, Short-Lived Climate Pollutant (SLCP) goals:**
    - 20% reduction by 2020; 50% reduction by 2025; 75% by 2030
    - Less than 2% currently destroyed
  - **EPIC grants, with the BioMAT, are critical to incubating the industry**
    - Builds expertise, proves technology and advances supply chain
- ...to realize the industry's potential**



# ABEC #4 – Carlos Echeverria & Sons Dairy



CE&S will help anchor a digester cluster and serve as a demonstration facility advancing technology and financial models.

## Key Advances

1. Generate approximately 7000 MWh/Yr renewable electricity, near load
2. In the process, destroy roughly 15,000 MT CO<sub>2</sub>e/Yr
3. Utilize waste heat to cool milk -- saving ~1000 MWh/Yr
4. Contribute portion of biogas to a future, centralized R-CNG facility



# CE&S Milking Parlor



# Innovations: Dairy Combined Heat & Power



## Electricity Generation

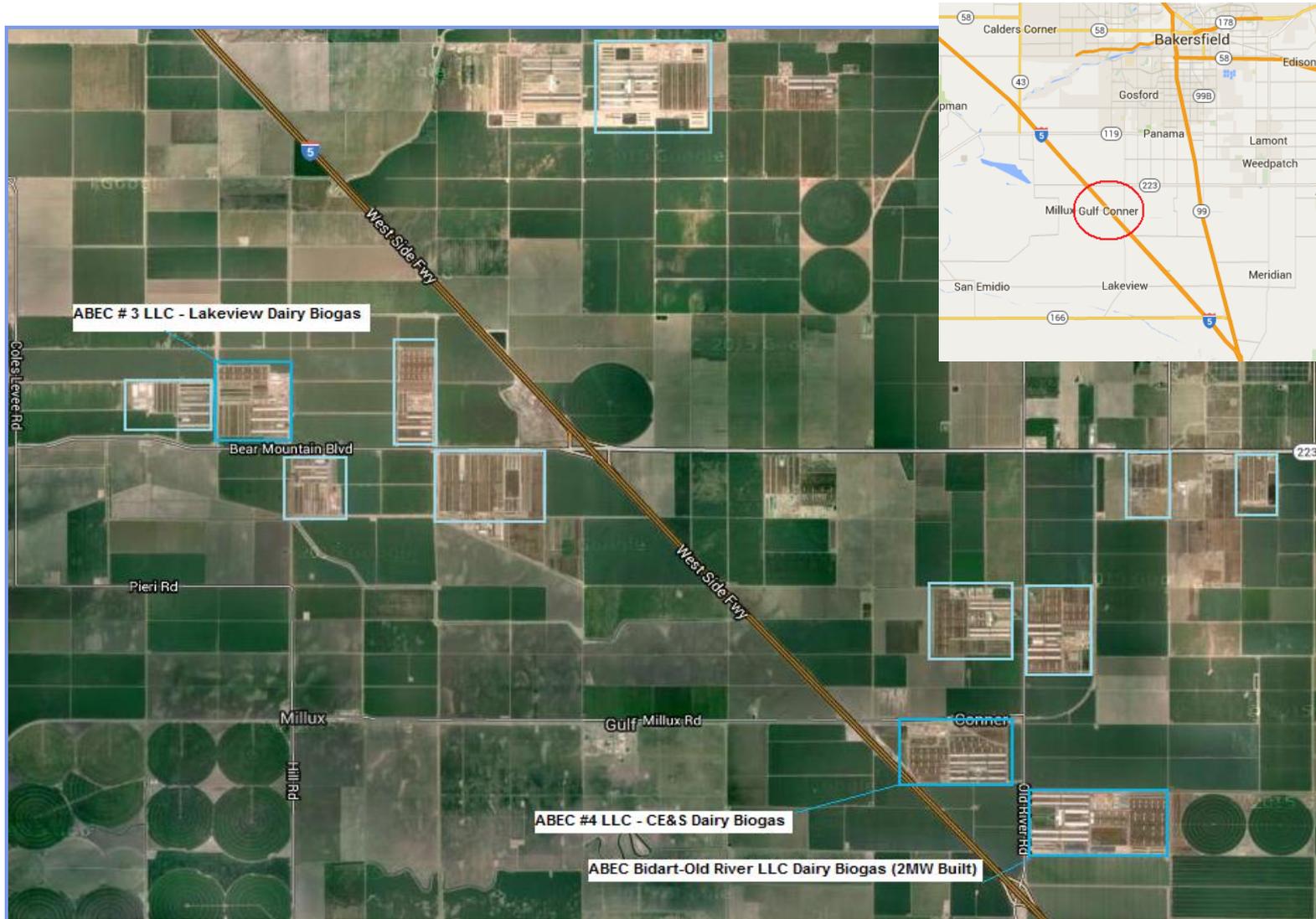
- Generate 1 MW and 7,000 MWh per year of renewable energy via methane destruction
- Nearly offset the dairy's load
- Export to PG&E via BioMAT
- Power 1 home per 4 cows



## Waste Heat Utilization

- Milk is kept at ~ 40 degrees
- Waste heat harnessed through absorption chiller to cool milk (100 tons waste-heat fired capacity)
- Save ~ 1,000 MWh year

# CE&S, Lakeview – and the Dairy Cluster



# Phase 1 + Phase 2 Future Demonstration



## **Phase 1:** Elec. + CH<sub>4</sub> destruction

- Build digester (lagoon and other)
- Generate renewable electricity while destroying methane
- Advance CHP/energy efficiency
- Co-benefits: gen electricity near load, enhance groundwater protection, reduce odors

## **Phase 2:** Add R-CNG facility

- Build a centralized R-CNG plant harnessing a portion of biogas

### Impacts:

- Financing advancement – balance stable electricity contracts with volatile credits
- Lower NO<sub>X</sub> emissions



# Lagoon Digester – Liner installation





# Covered Lagoon and Old Lagoon





# Engine Building and Interconnection





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