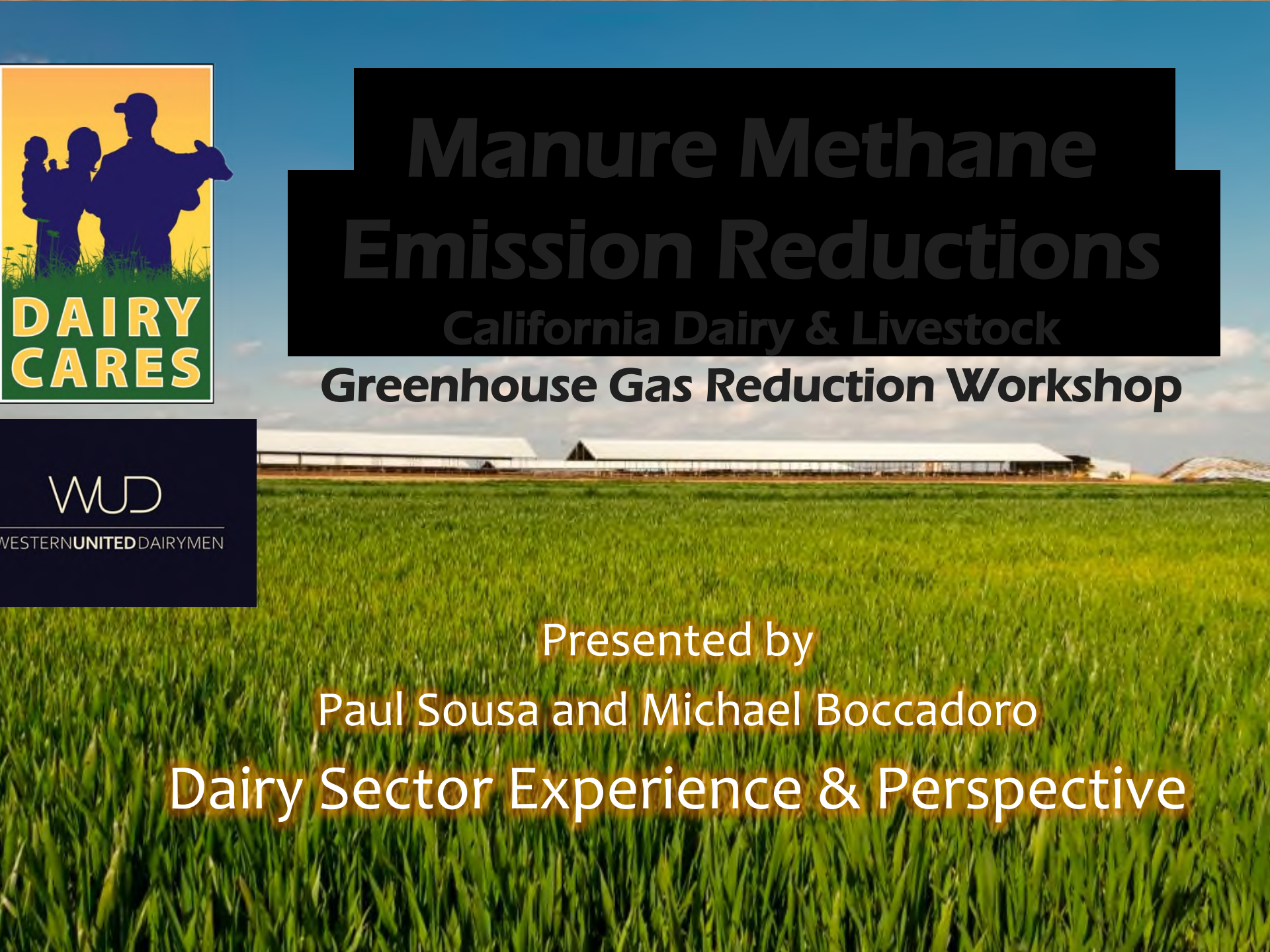


Manure Methane Emission Reductions

California Dairy & Livestock

Greenhouse Gas Reduction Workshop

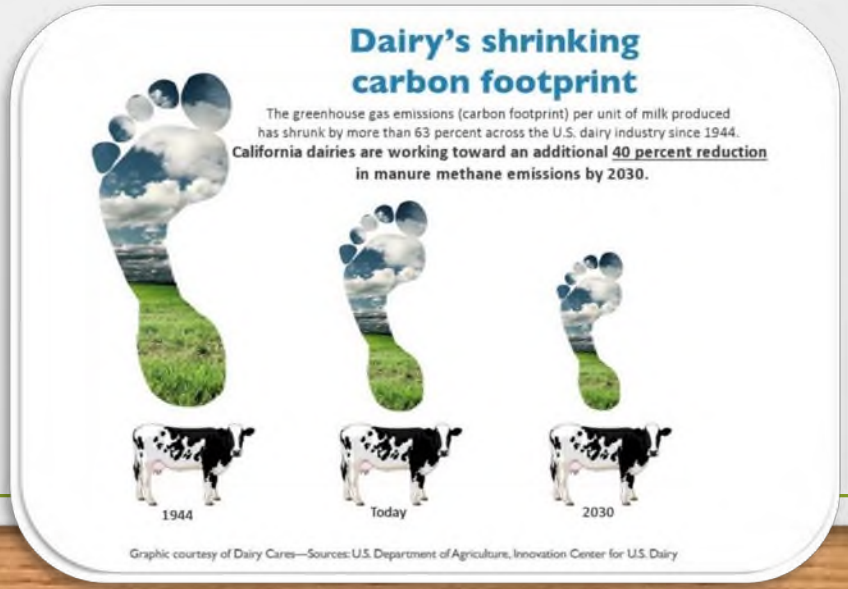
Presented by

Paul Sousa and Michael Boccadoro

Dairy Sector Experience & Perspective

Partnership

- Achieving state's ambitious 40 percent manure methane reduction target will take concerted effort and partnership between industry, state and stakeholders.
  - ✓ The importance of this effort to identify barriers to reduction efforts and address implementation issues is critical



DAIRY CARES

Approach

- Senate Bill 1383 is based on a voluntary and incentive based approach to achieving reductions
  - ✓ Critical given high leakage potential of industry
  - ✓ Zero ability to pass on costs
  - ✓ Key is developing projects that provide a return on investment
- More than 50 dairies closed in California last year
  - ✓ Nearly 600 lost in the last decade

Dairy diversity

- Approximately 1,400 family-owned and operated dairies in California. These dairy operators vary greatly in size, manure handling practices and location
  - ✓ What works for dairies on the North Coast may be different from what works for dairies in the Central Valley
- No silver bullet to reducing emissions due to diversity of dairy operations. As a result, dairy operations will need a suite of solutions
- CDFA's and ARB's analysis have both shown that we can't get there with just digesters and certainly can't get there by converting all dairies to pasture

DAIRY CARES

Identify alternatives

- Efforts to identify alternative manure management practices that reduce methane emissions are critical
  - ✓ Solids separation and conversion to dry manure handling are two promising alternatives
  - ✓ Additional research to better understand emissions and opportunities to control them will be critical

Investment

- Ongoing incentives and investment will be key
  - ✓ Development of protocols for GHG credit development will also prove helpful
- CDFA has estimated $100 million per year will be needed

Role of *digesters*

- While not the only solution, digesters will prove critical to achieving large scale reductions sought by state
  - ✓ Digesters not only have the potential to reduce GHG and methane, they can also create valuable, flexible and dispatchable renewable energy

Dairy Manure Digester Development in California

1. **ABEC-Bidart-Old River**
2. **ABEC-Bidart-Stockdale**
3. **Blakes Landing Farms/Straus Family Creamery**
4. **Castelanelli Brothers Dairy**
5. **Cottonwood Dairy/Joseph Gallo Farms**
6. **Denier Dairy**
7. **Fiscalini Farms**
8. **Giacomini Dairy**
9. **Hilarides Dairy**
10. **New Hope Dairy**
11. **Open Sky Ranch**
12. **Pacific Rim Dairy**
13. **Pixley Biogas**
14. **Van Steyn Dairy**
15. **Van Warmerdam Dairy**
16. **Verwey Dairy– Hanford**

Under Construction

17. Verwey Dairy– Madera
18. GJ TeVelde Ranch
19. Carlos Echeverria & Sons Dairy
20. Lakeview Dairy
21. West Star Dairy

Environmental co-benefits

- Digester projects can also provide valuable environmental co-benefits
  - ✓ Modest benefits to water quality
  - ✓ Potential to reduce air contaminants
  - ✓ And even significantly reduce NOx and PM 2.5 (diesel particulate) in some applications
- A digester making RNG transportation fuel on 5,000 cow dairy can reduce NOx by as much as 16 tons per year

Current Best Options for Capture

- Multiple uses for captured biogas:
  - ✓ Generate electricity
  - ✓ Pipeline injection
  - ✓ Transportation fuel

Electricity

Renewable Natural Gas (RNG)

Vehicle Fuel (RCNG)

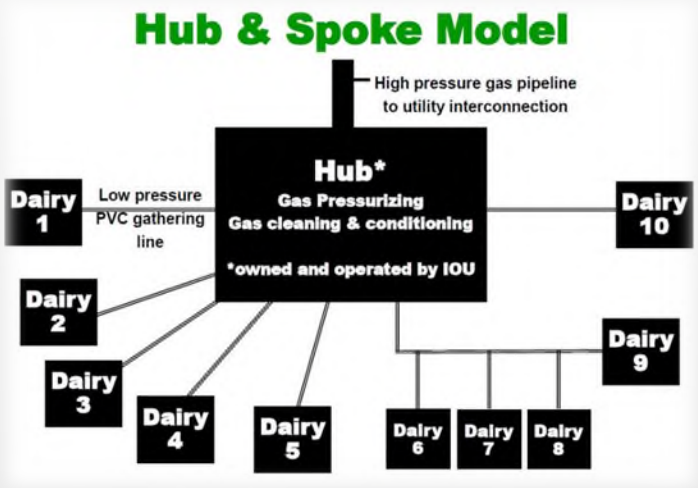
CNG Fuel Station

Integration of incentives

- Numerous programs designed to incentivize dairy methane reductions generally and digesters specifically
  - ✓ One goal of this effort should be to provide better coordination and integration

Cluster opportunities

- Tremendous opportunity with dairy cluster projects to demonstrate how we move from concept to pipeline injection and carbon negative transportation fuel
- CPUC development of 5 dairy biomethane projects critical



Project Financing 101

- 3 primary sources of revenue
  - ✓ Grants
  - ✓ Energy sales
  - ✓ Credit sales
- Typical electricity project is
  - ✓ 75-80% energy sales
  - ✓ 20-25% credit sales
- Typical transportation fuel project is
  - ✓ 20% fuel sales
  - ✓ 80% credit sales

** Establishing a mechanism to provide long-term certainty for credits is key to fuel projects*

Worthwhile investment

- Digester investment is among the most cost effective GHG reduction programs funded by state
  - ✓ SLCPs are estimated to be responsible for 40% of current climate forcing
  - ✓ SLCPs only slated to receive $95 million for all programs - $50 million for dairy manure management – **less than 3% of total funds**
  - ✓ Fastest return on investment
    - Short-lived benefits realized faster/provide immediate benefits

Contributing to current success

- "Failure" criticism is misplaced
  - ✓ Small number of early pilot projects are not currently operational
  - ✓ Mostly economic reasons and changing air quality regulations
  - ✓ Several under consideration for re-operation
  - ✓ Great deal has changed as we learned from these projects
  - ✓ Rather than being criticized for failure they should be recognized for contributing to current success

Pasturing has limitations

- Dairies can't pasture their way to dairy methane reductions. As stated earlier, pasture based dairies are great and they provide an important industry niche, particularly for organic milk production
  - ✓ Higher enteric emission
  - ✓ More cows to achieve same level of production
  - ✓ More land due to lower stocking rates and more cows
  - ✓ More water due to need to irrigate pasture in valley

Conclusion

- Achieving state's ambitious 40 percent manure methane reduction target will take concerted effort and partnership between industry, state and stakeholders.
  - ✓ We have a lot to do so let's get started