Nutrient Recovery within an AD Platform: Partitioning of Nutrient Streams and Production of Value-Added Products

Craig Frear, PhD
Assistant Research Professor

EPA Technology Market Summit
Washington DC

May 14, 2012
Concentrated CAFO Regions

Due to expense of transporting liquid manure, soils nearby to some CAFOs have become over-burdened with phosphorus, nitrogen, and/or salts (USDA APHIS, 2005). Some regions now report levels in excess of national and state standards for \textit{PM 2.5 air quality, surface P, and groundwater nitrate}. 

- Chesapeake Bay
- Mississippi River Valley
- Pecos Valley, NM
- Columbia Basin, WA
- Central Valley, CA
- Magic Valley, ID

Pecos Valley, NM
- 60,000 cows
- 1 M gallons/day
- 10 mile radius
Take Home Message

As opposed to simply transforming a portion of organic nutrients to more bioavailable inorganic form (present sales pitch), a paradigm shift is required—nutrients must be removed from the area.

This can only be done by concentrating and partitioning a portion of the nutrients through active nutrient recovery processing.

Thus, next-generation AD must be a combination of AD and nutrient recovery; it is through this combination that serious nutrient threats are minimized and AD adoption is accelerated. Not AD for power, AD for environmental control, which also makes power.

Must have a viable business plan: must be able to provide cost-effective technologies with viable markets and policy incentives.
Co-Digestion (30% volume)
$210,000 + $173,000 + $150,000/year
(assume tipping fee, 2x biogas, 2x N, 1x P)

1,000 Cow Scrape Dairy
(30 gallons/cow day)

$173,000/year @ $0.08/Kwh
60 ft³ CH₄/cow day

11 M gallons/year
• 170 tons N/year
• 30 tons P/year
• 80 tons K/year

3,400 tons fiber/year
@ 70% moisture

Install nutrient recovery technology
70% NH₃; 80% P; 20% K Recovery (~6:1:6)

S/L

115 tons N/year
25 tons P/year
75 tons K/year

Use Existing Lagoon Water (~2:1:2)

Option 1
Agronomic application
to 1,250 acres corn
(160 pounds/acre at 2:1:2)

70 tons N-Fertilizer &
25 tons P-Fertilizer
($150,000 + $85,000/year)
(at $450/ton AS & $50/ton P-solid)

Option 2
Agronomic application
to 640 acres alfalfa
(25 and 180 pounds
P and N/acre)

Export 56%, 83%, and 25% of N, P, K, respectively. Nutrient co-product sales at 1.6x the electricity. Halve the number of acres and fuel to apply lagoon water. More effectively use nutrients on field.