The “Green” Gold Rush: Opportunities and Risks of Carbon Markets for Dairies, Digesters & Beyond

Carbon Market Economics and Risks

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Seeing the Forest through the Trees

The Forest: Improving dairy sustainability.

The Trees: The multitude of risks facing dairy farmers to achieve the sustainability goals of the forest.

Risk and opportunity

- WA Available Capital investment cost share **($30 million)**

  Summary of California dairy projects

  - Number of Projects 122
  - CDFA Grant Avg $1.599 M
  - Average Matching $3.217 M
  - Average Total $4.816 M

- Regulation requirement (CA) vs Economic incentive (WA)
- High dairy methane capture ROI to cost share
- Developing regulatory and voluntary carbon markets
- Developing science on quantifying carbon capture, sequestration, etc.
- Risk creates potential for profits or losses
- Methane capture investment by the dairy farm faces risk in all 5 agricultural risk categories

5 Risk Categories

1. **Production risk – Variation in yield**
   - Measurement and variance in biogas yield (methane to CO_2e calculation)
   - Depends on system AD vs lagoon cover, temperature, electricity vs natural gas
   - Engineering design, construction and potential capacity constraints
   - Maintenance and management

2. **Market risk – Variation in input and market prices**
   - Regulation created (i.e. LCFS) market and methane capture incentives
   - Developing voluntary carbon markets for methane / CO_2e capture
   - Electricity and natural gas prices
   - Value from RINs and potentially eRINs

3. **Finance risk – variation in cash flow**
   - Long investment recovery period – 15+ years
   - Tax incentives – Depreciation; Federal and State Investment Tax Credits
   - Low dairy milk production profitability ability to cover biogas losses

4. **Legal risk – Legal and regulatory rules**
   - Policy permanence (Initiative 2117)
   - Contracts, Nondisclosure clause in contracts, new biogas LLC

5. **Human risk – Business risks from dealing with people and new management challenges**

Initiative 2117 Legislative Process

Initiative to the Legislature

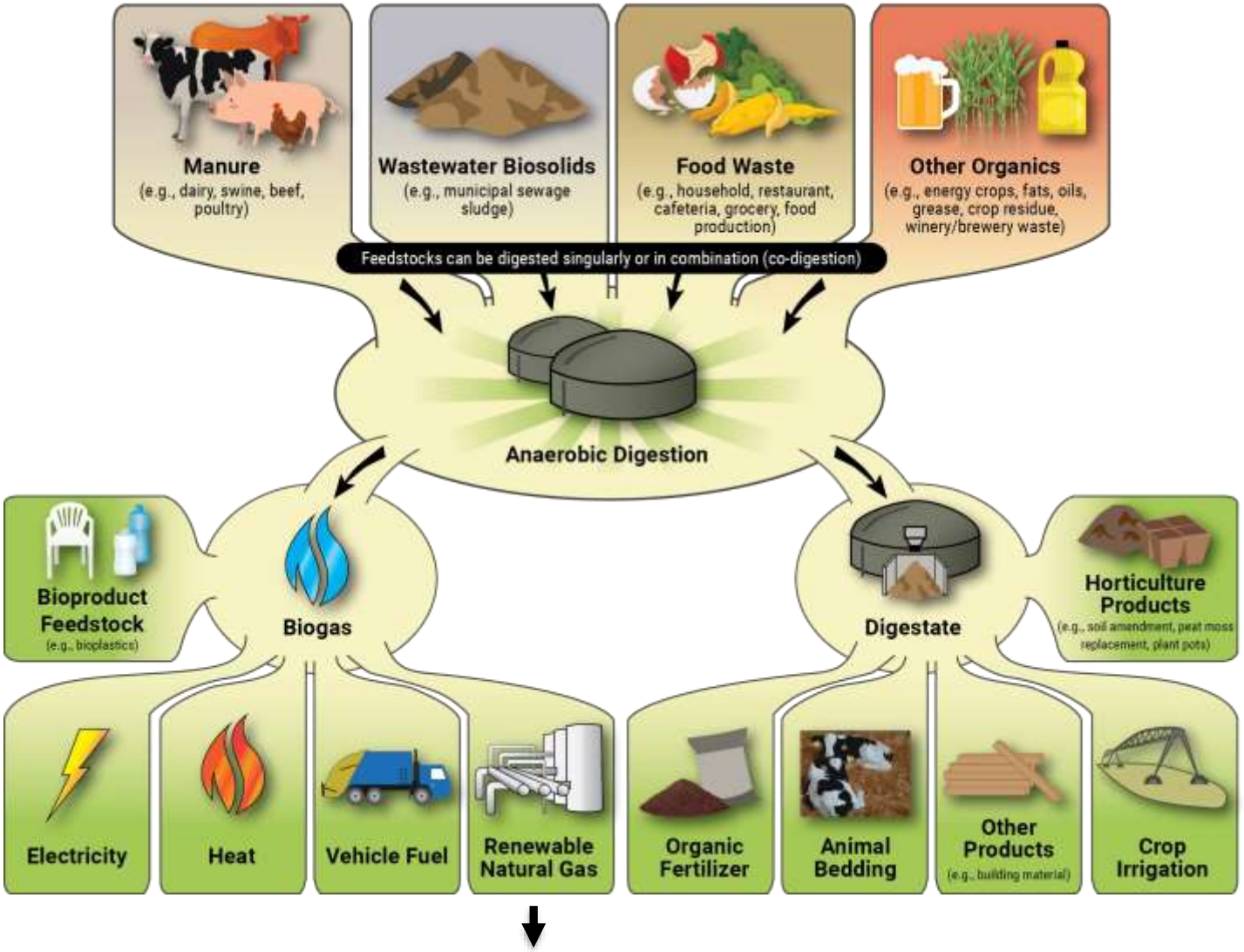
Initiatives to the Legislature are submitted to the Legislature at its regular session each January. Once submitted, the Legislature must take one of the following three actions:

- The Legislature may adopt the initiative as proposed and it becomes law without a vote of the people;
- The Legislature may reject or refuse to act on the proposed initiative and the initiative must be placed on the ballot at the next state general election; or
- The Legislature may propose a different measure dealing with the same subject and both measures must be placed on the next state general election ballot.

https://leg.wa.gov/LIC/Documents/EducationAndInformation/SOSInitRefHandbook.pdf

Office of the Secretary of State

Anaerobic Digestion Production of Gas and Electricity

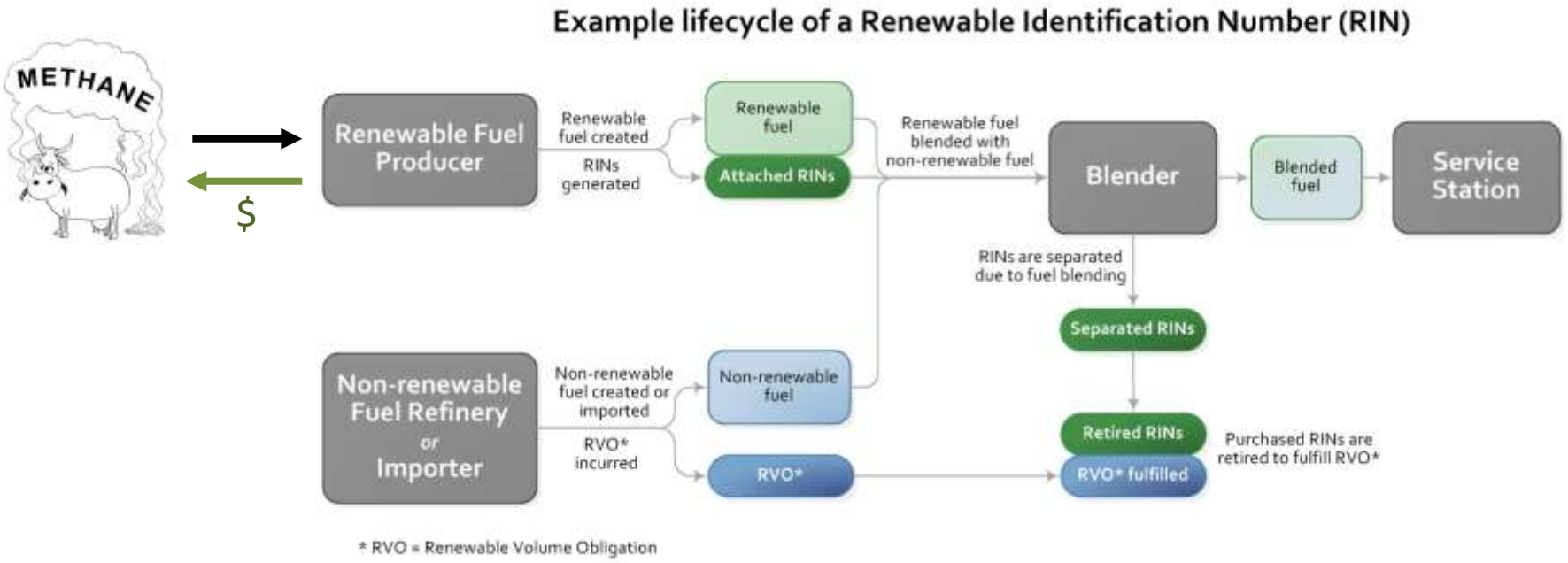


Clean Fuel Standard - Chapter 173-424 WAC,
RNG Prices, LCFS and RINs Incentives

Renewable Natural Gas (RNG) from Dairy Manure

Value of RNG from dairy manure Anerobic Digestion

1. Commodity natural gas price
2. Low carbon fuel credits (LCFS in CA, CFS WA)
3. RINS (Renewable Identification Numbers)
   - "currency" of the Federal Renewable Fuel Standards Program
   - RVO = Renewable Volume Obligation, set by EPA rulemaking



https://www.epa.gov/renewable-fuel-standard-program/renewable-identification-numbers-rins-under-renewable-fuel-standard

RINs - D3 cellulosic, D5 advanced, D4 biodiesel, D6 corn ethanol

Weekly D3 RIN Prices 2019 through 2023 ($/RIN)

A RIN is **a 38-character number assigned to each physical gallon of renewable fuel produced or imported**.

https://www.epa.gov/fuels-registration-reporting-and-compliance-help/rin-trades-and-price-information

How much support will D3 prices get from future RVOs

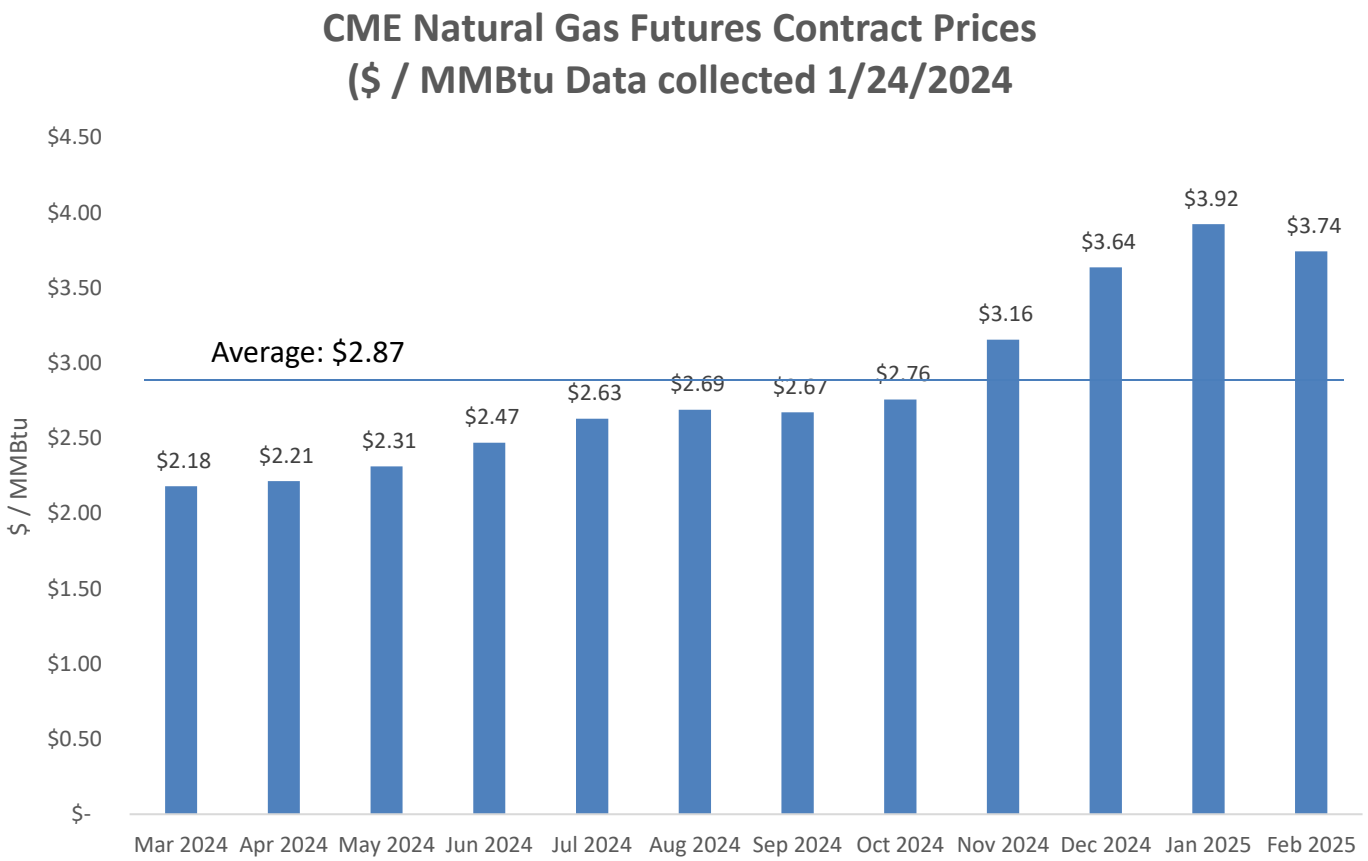
EPA D3 RIN /RVO Volume Targets				
	2022	2023	2024	2025
Cellulosic biofuel (D3)	630,000,000	840,000,000	1,009,000,000	1,380,000,000
Percent Change		133%	120%	137%

https://www.epa.gov/renewable-fuel-standard-program/proposed-renewable-fuel-standards-2023-2024-and-2025

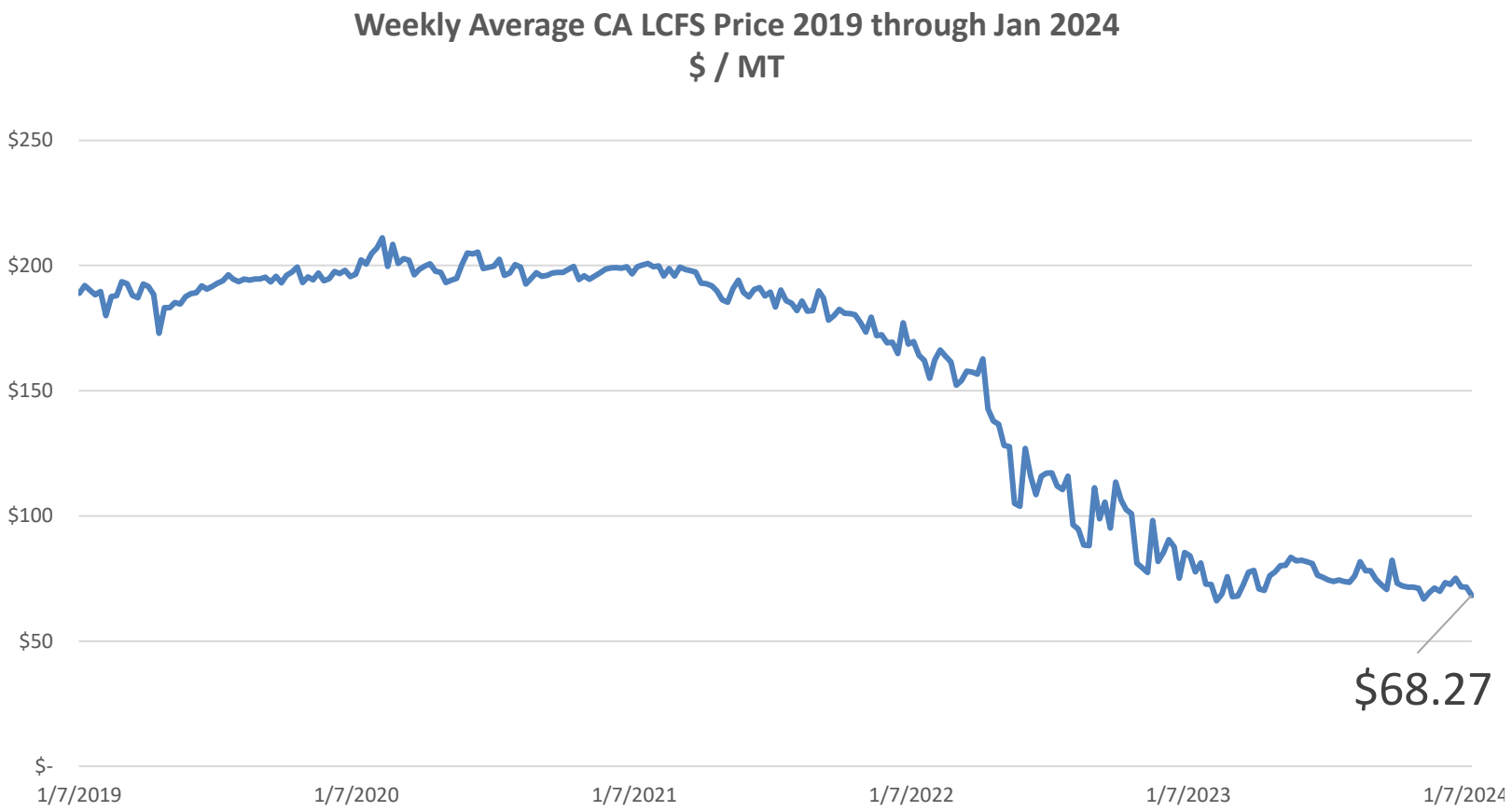
Trend in Natural Gas Prices (2020 to 2024)

https://tradingeconomics.com/commodity/natural-gas

CME Natural Gas Futures Outlook



CA LCFS Price Trend



https://ww2.arb.ca.gov/resources/documents/weekly-lcfs-credit-transfer-activity-reports

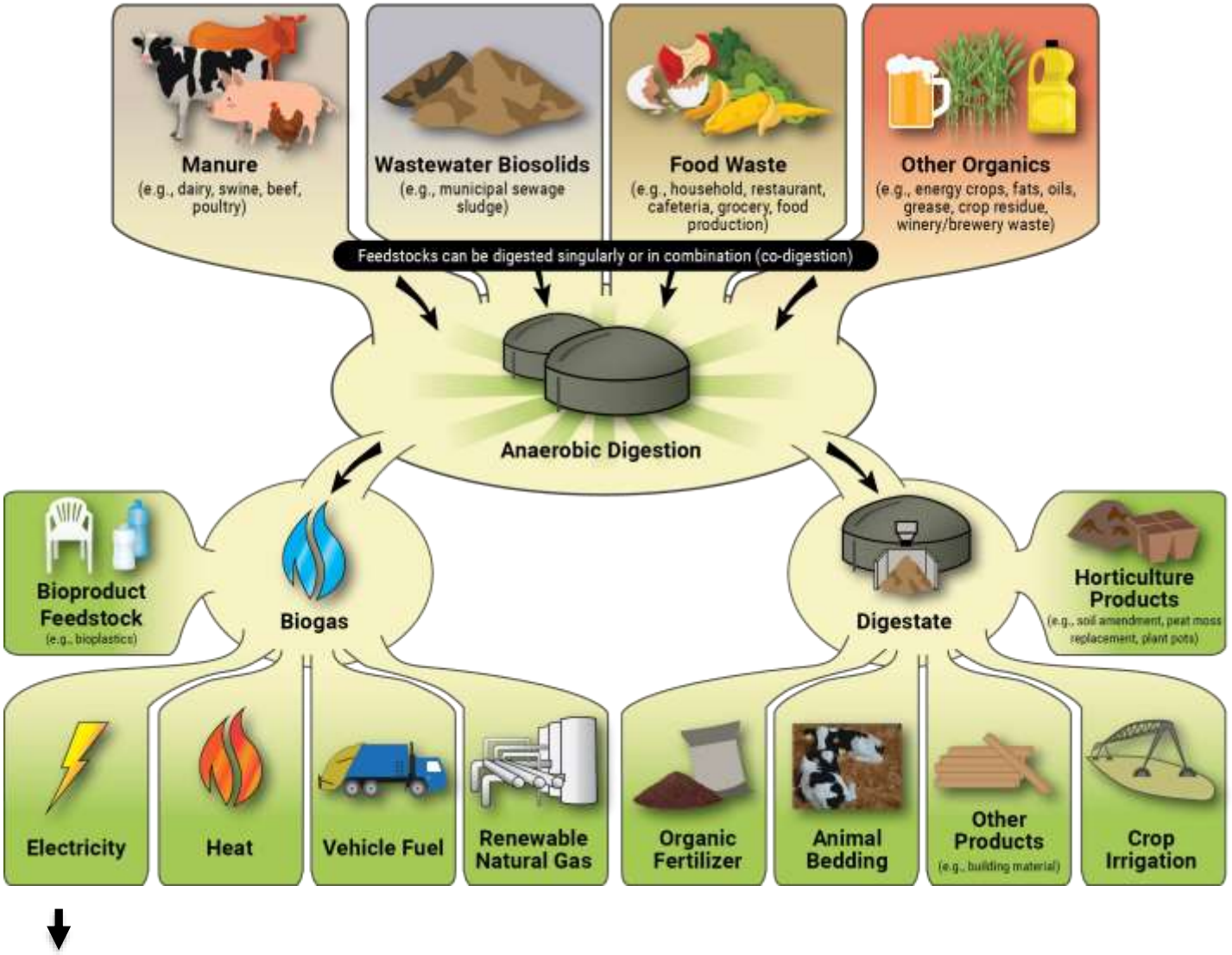
Estimate of revenue per cow generated from gas

A dairy cow generates 22.5 MMBTU / Year

			Revenue	
Sale of gas	$3.00 / mm btu	22.5 mm btu	$	67.50
D3 RINs	$3.00 / RIN	292 RINs / cow	$	876.00
LCFS	$68.27 / MT	16.13 / cow	$	1,101.20
		Total / cow	$	2,044.70
Milk revenue	$21 / cwt milk price	23,000 lbs	$	4,830.00

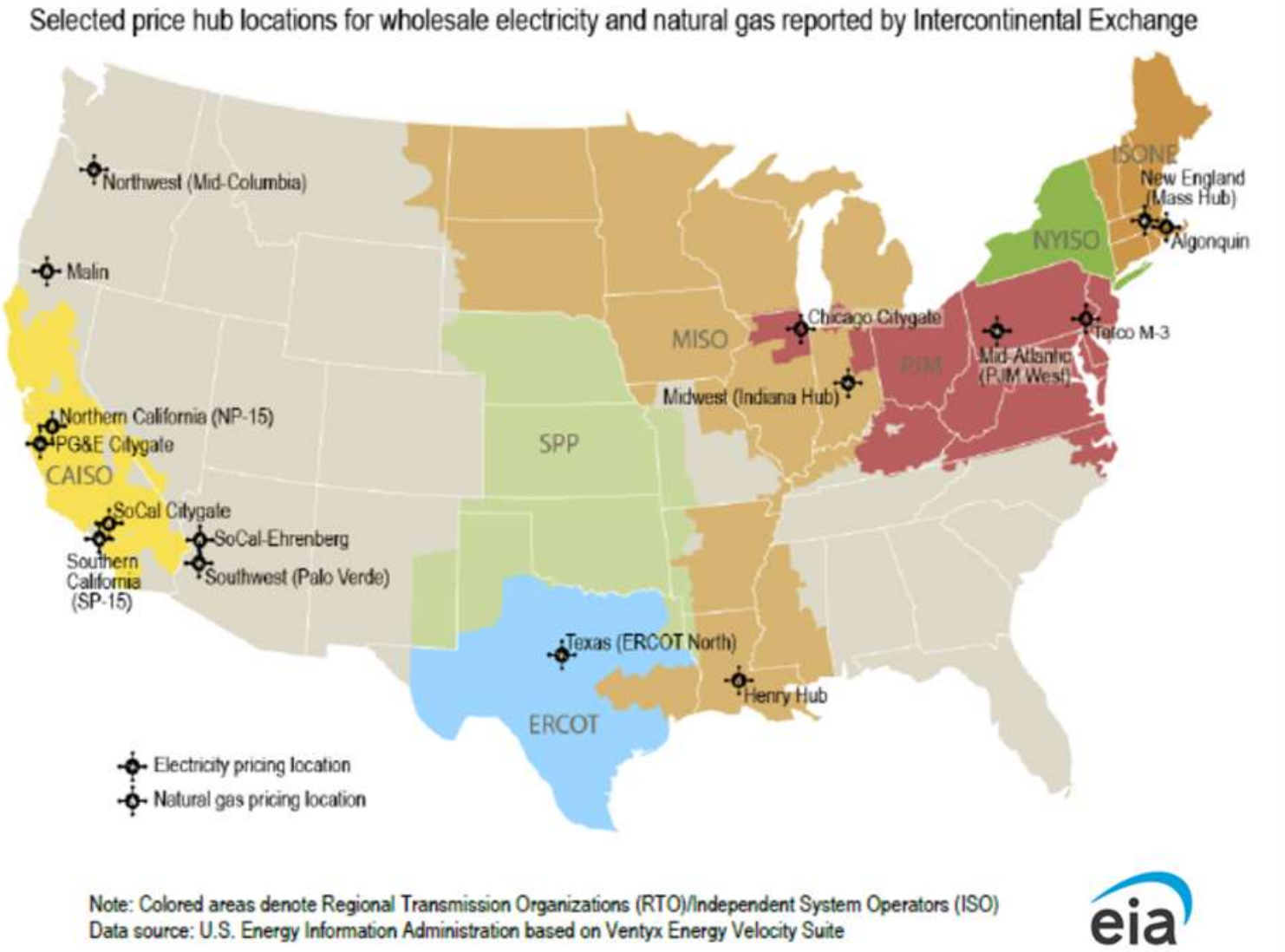
https://asmith.ucdavis.edu/news/revisiting-value-dairy-cow-manure

Anaerobic Digestion Production of Gas and Electricity

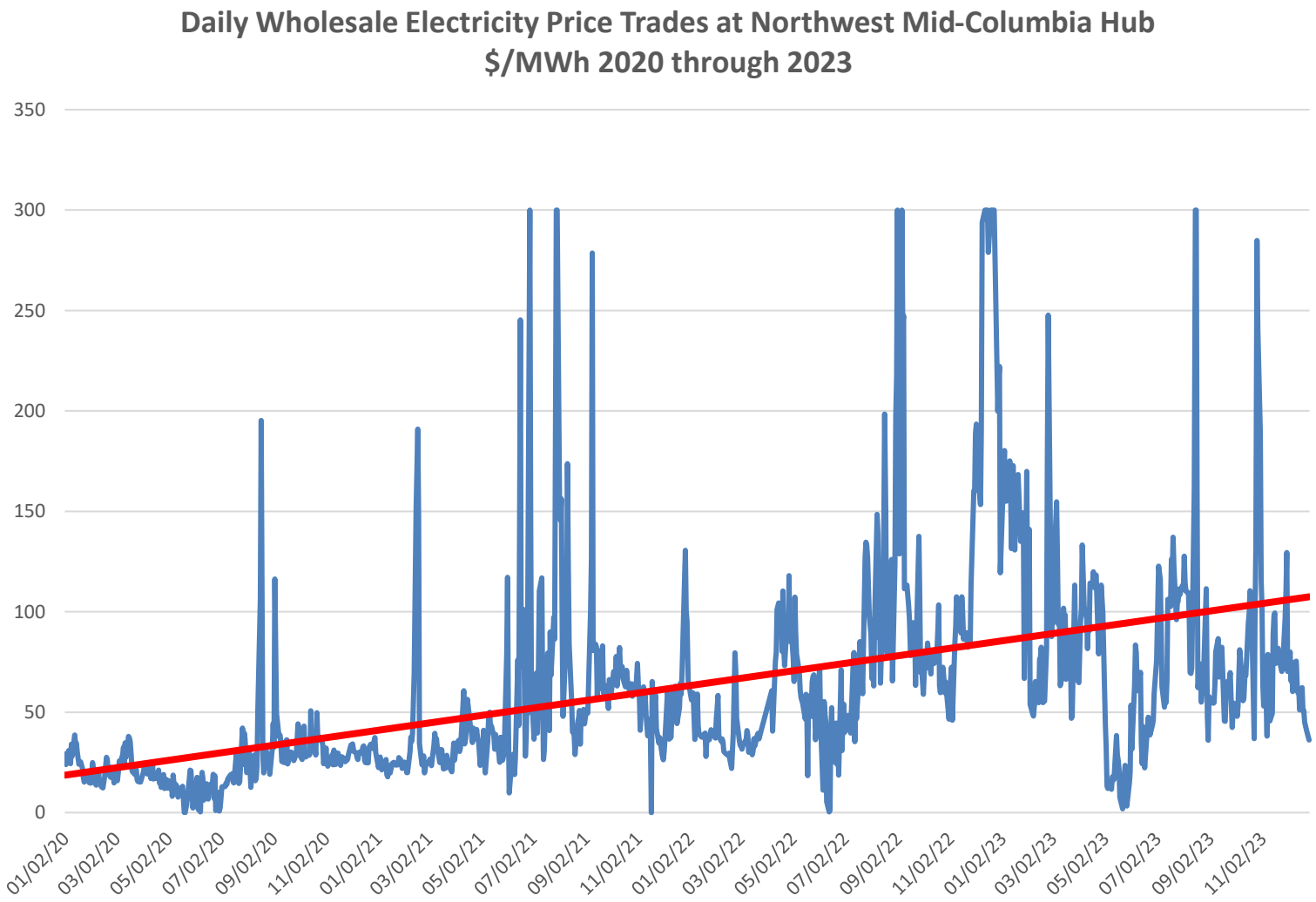


Profitability of AD generating electricity consideration

Electrical Wholesale Price Market Map



Electrical Wholesale Price Trend



https://www.eia.gov/electricity/wholesale/#history

eRINs Policy and Outlook

EPA United States Environmental Protection Agency

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EPA Finalizes New Renewable Fuel Standards to Strengthen U.S. Energy Security, Support U.S. Rural Economy, and Expand Production of Low-Carbon Fuels

Final rule sets balanced biofuels growth from 2023 to 2025, reducing reliance on up to 140,000 barrels of foreign oil imports per day

June 21, 2023

EPA continues to assess the comments received on proposed regulations governing the generation of Renewable Identification Numbers (RINs), which are RFS compliance credits, for electricity made from renewable biomass that is used for transportation fuel (eRINs). The EPA will continue to work on potential paths forward for the eRIN program, while further reviewing the comments received on the proposal and seeking additional input from stakeholders to inform potential next steps on the eRIN program.

June 21, 2023

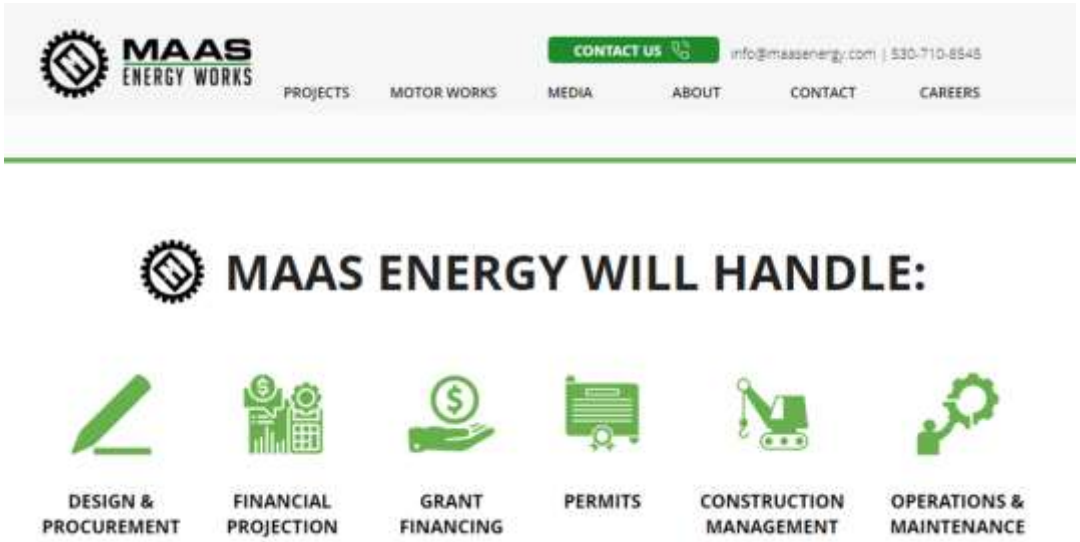
Points of Information from California dairy projects

Year of Award	Applicant Organization	Project Title	Submitting Organization	Project Location	Cluster	Project Type	Biogas End-Use	Estimated 10 year GHG reductions ($MTCO_2e$)*	Grant Funds	Matching Funds**	Total Project Cost	Status
2019	Calgren Dairy Fuels LLC	Northstar Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	170,658	$1,576,438	$1,576,438	$3,152,876	In Progress
2019	Nyman Brothers Dairy Biogas	Nyman Brothers Dairy Biogas	California Bioenergy LLC	Hilmar, Merced Co.	Hilmar	New covered lagoon digester	RNG	68,026	$687,006	$4,654,902	$5,341,908	In Progress
2019	Poplar Lane Dairy Biogas LLC	Poplar Lane Dairy Digester Pipeline Project	Maas Energy Works Inc	Hanford, Kings Co.	Lakeside	New covered lagoon digester	RNG	131,195	$1,756,966	$1,756,966	$3,513,932	In Progress
2019	Rib-Arrow Dairy Biogas	Rib-Arrow Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	76,343	$657,231	$3,517,919	$4,175,150	In Progress
2019	Ribeiro Dairy Biogas	Ribeiro Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	132,348	$1,124,962	$1,613,882	$2,738,844	Complete
2019	Rio Blanco Dairy Biogas	Rio Blanco Dairy Biogas	California Bioenergy LLC	Tulare, Tulare Co.	South Tulare	New covered lagoon digester	RNG	100,886	$1,002,797	$2,556,018	$3,558,815	In Progress
2019	Calgren Dairy Fuels LLC	Schott Dairy Digester Pipeline Project	Maas Energy Works Inc	Tipton, Tulare Co.	Calgren	New covered lagoon digester	RNG	129,082	$1,444,592	$1,444,592	$2,889,184	In Progress

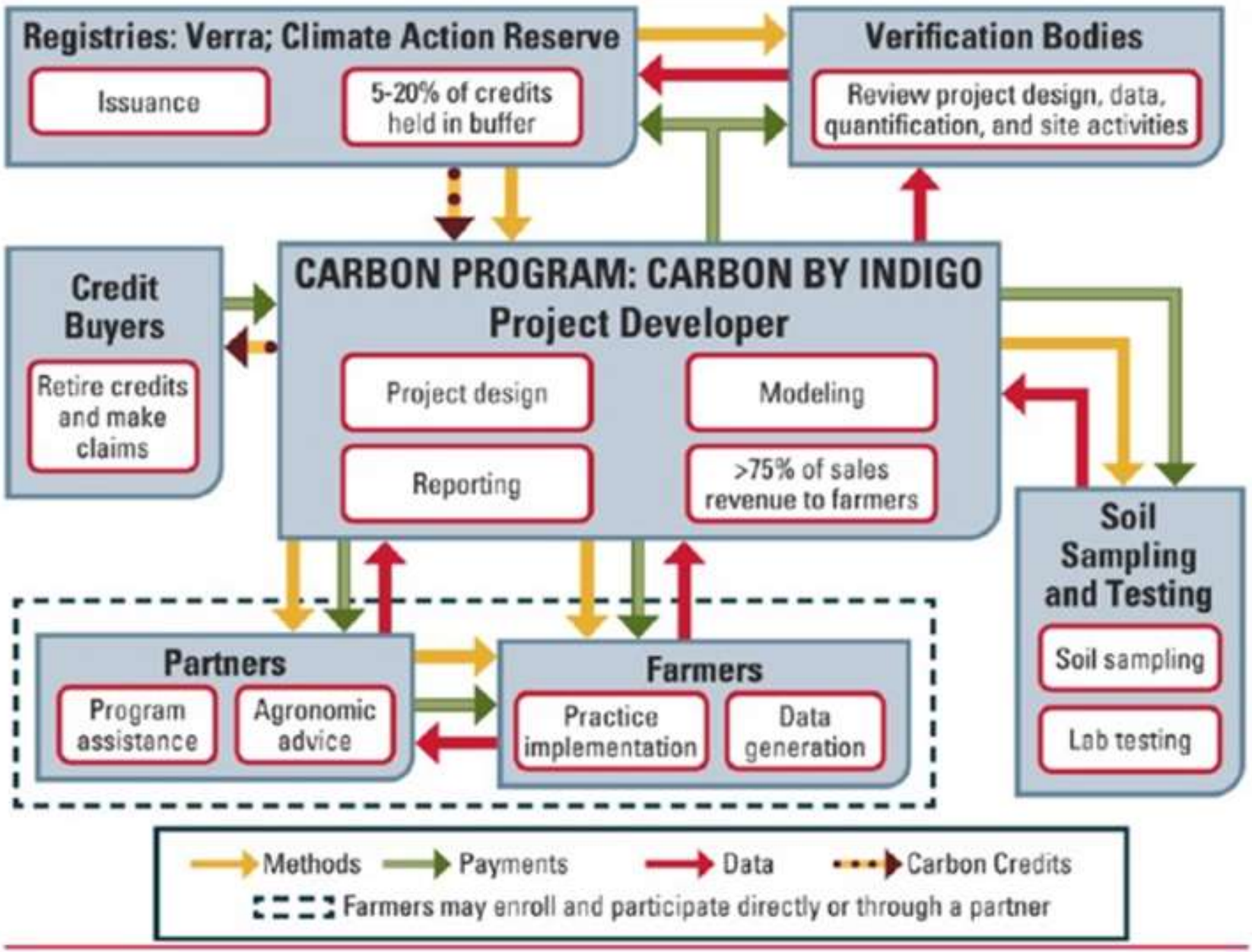
- Applicant organization –
  - New dairy organization LLC for biogas operations
- Submitting organization – Expert firm developing engineering and biogas business plan
- Designing dairy clusters and preponderance of New Covered Lagoon RNG projects

https://ww2.arb.ca.gov/sites/default/files/2022-04/dairy-ws-session-1-CARB.pdf

2 examples Submitting Organization



Carbon Credit Generation Flowchart – INDIGO example



Conclusions - Refocus on the Forest – Dairy Sustainability

- Commitment to dairy sustainability – Net Zero Initiative

- Recognize the value trends for capturing methane for
  - Natural gas
  - Electricity
  - Emerging technologies eg. hydrogen capture technology

- Recognize growing importance of carbon credit incentives
  - Programs supporting clean fuel standard
  - Voluntary carbon market
  - Regulated or compliance carbon market
  - https://carboncredits.com/carbon-prices-today/

- Low profit potential of Anaerobic Digestion without Incentives

- Washington $1.8 Billion generated in 2023 in allowance auction

Discussion and Questions

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