NORTHWEST BIOENERGY SUMMIT

Spokane
October 15th, 2024

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Director Research & Technology

REGENIS

REGENIS, LLC

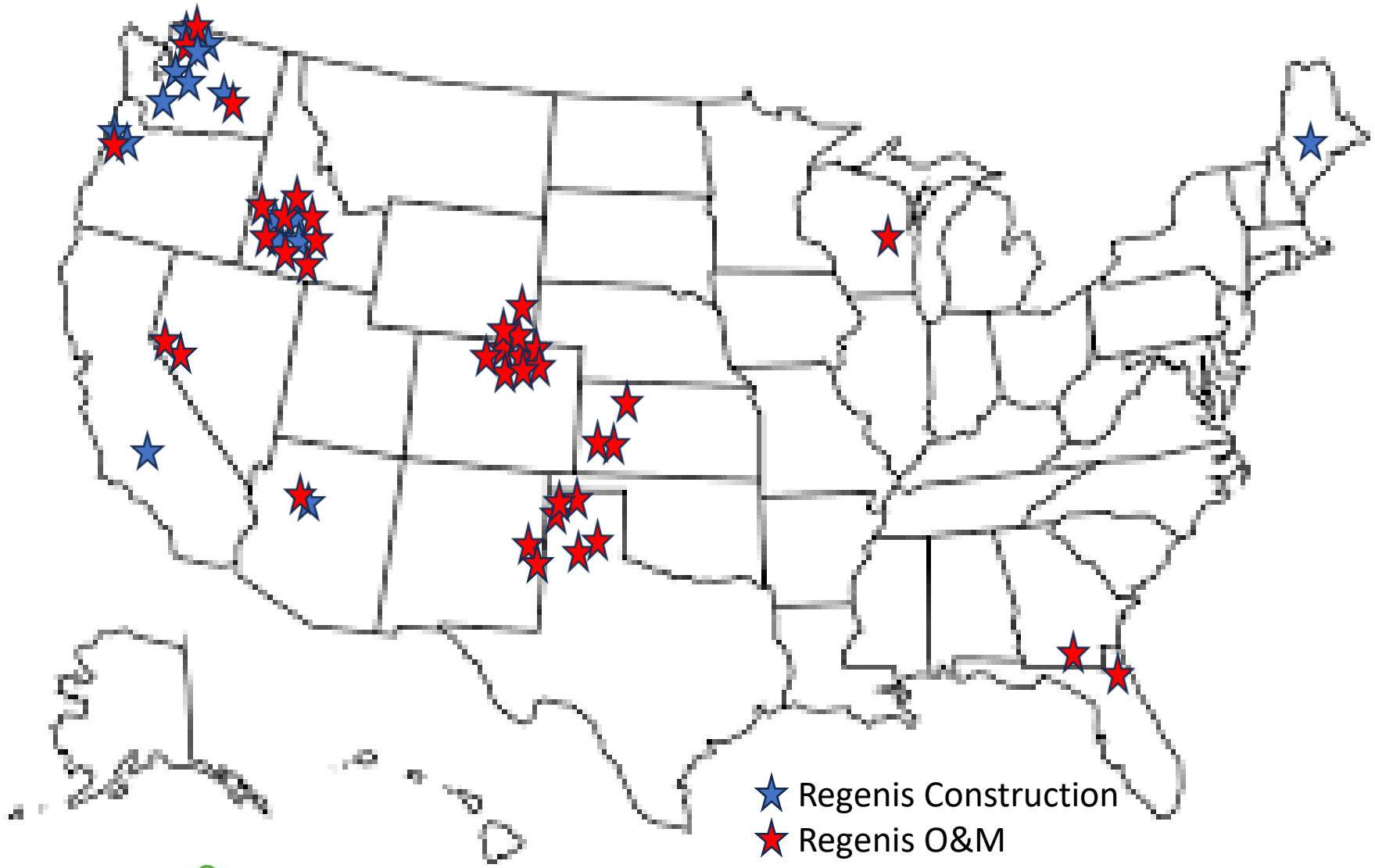
Offices in Ferndale WA and Jerome ID

110 Employees

Provides Anaerobic Digestion Services for Dairy Manure Projects

- EPC
- Construction Management
- O&M
- Consulting

Renewable Natural Gas, Electricity, Post-Digestion Solids Treatment, Nutrient Treatment



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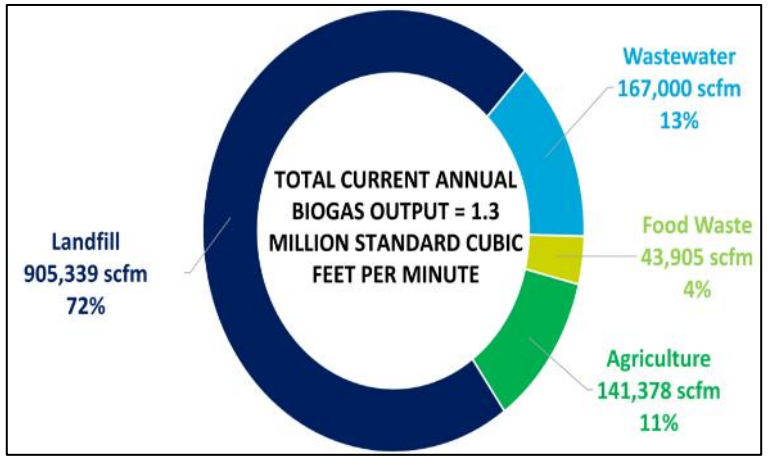
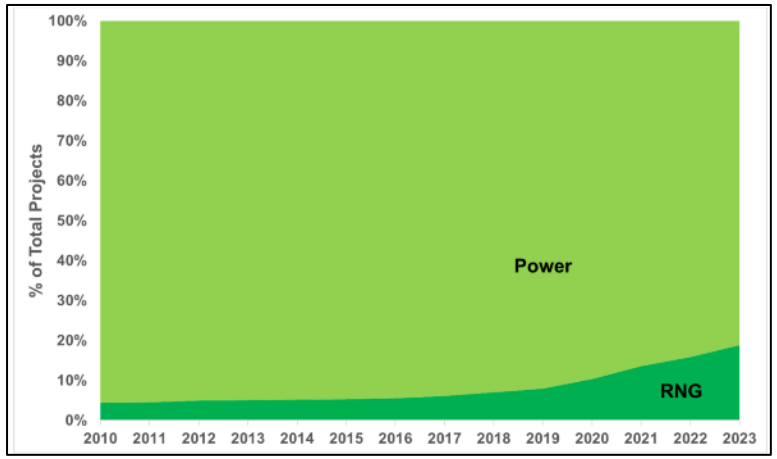
WHY AD IS OF INTEREST

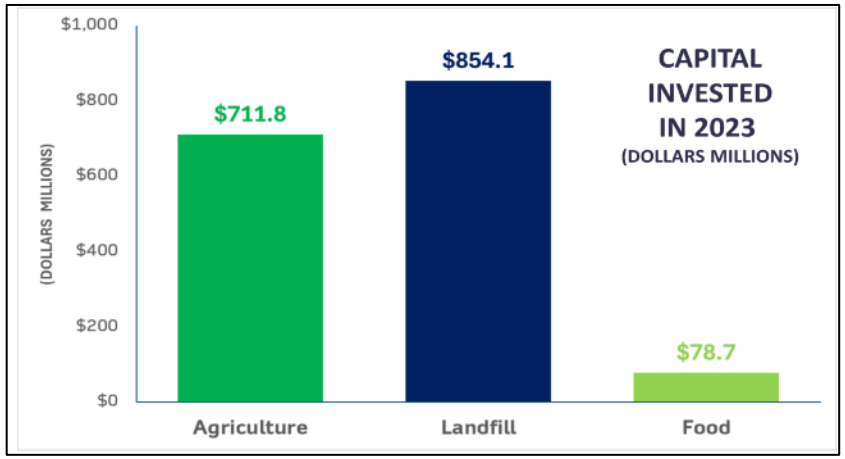
- ✓ US, regulators, milk product marketers, corporations are becoming more and more interested in renewable energy/fuel, environmental footprint, and climate change.
- ✓ Anaerobic digesters and/or alternative manure management techniques can help reduce methane emissions from dairies – generating ***negative carbon*** fuel for CNG trucks, EVs, and future vehicles (i.e., hydrogen)
- ✓ **Anaerobic digesters hold *potential* for doing this while turning a profit and providing *some* return to dairies.**
- ✓ Federal and state credit programs, and other incentives (i.e., grants, tax credits, etc.) are vital to development

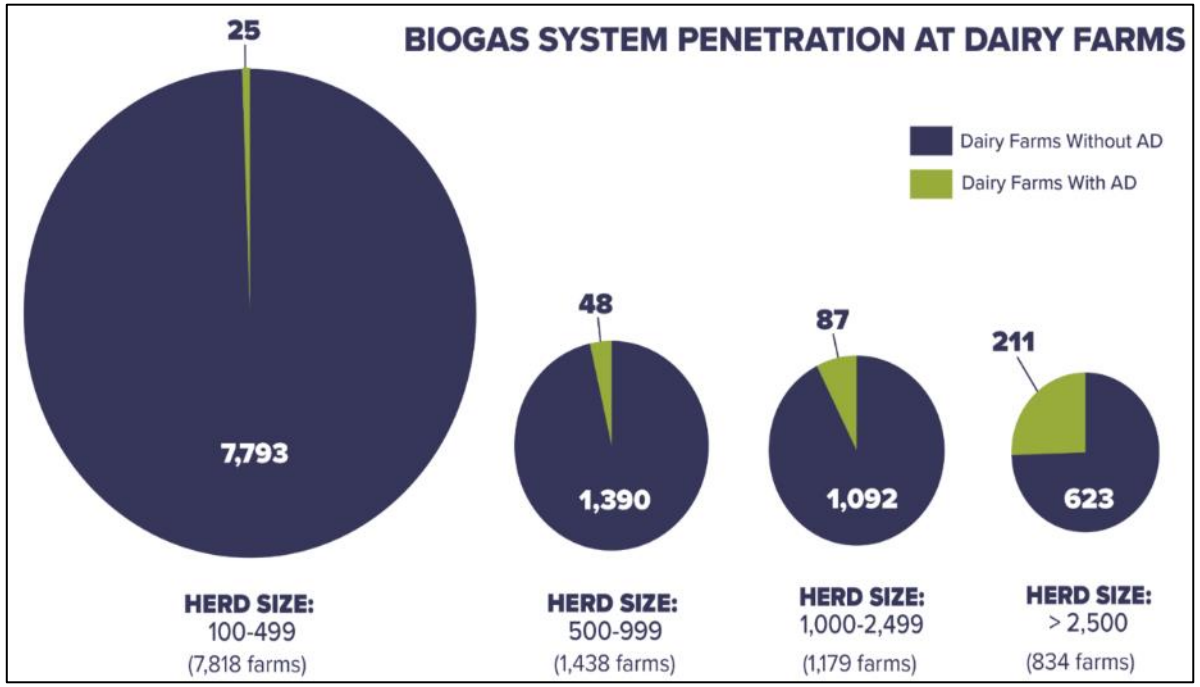
5,200 milker, 400 SCFM biogas facility in Clinton ME–
1 million diesel gallon equiv. per year

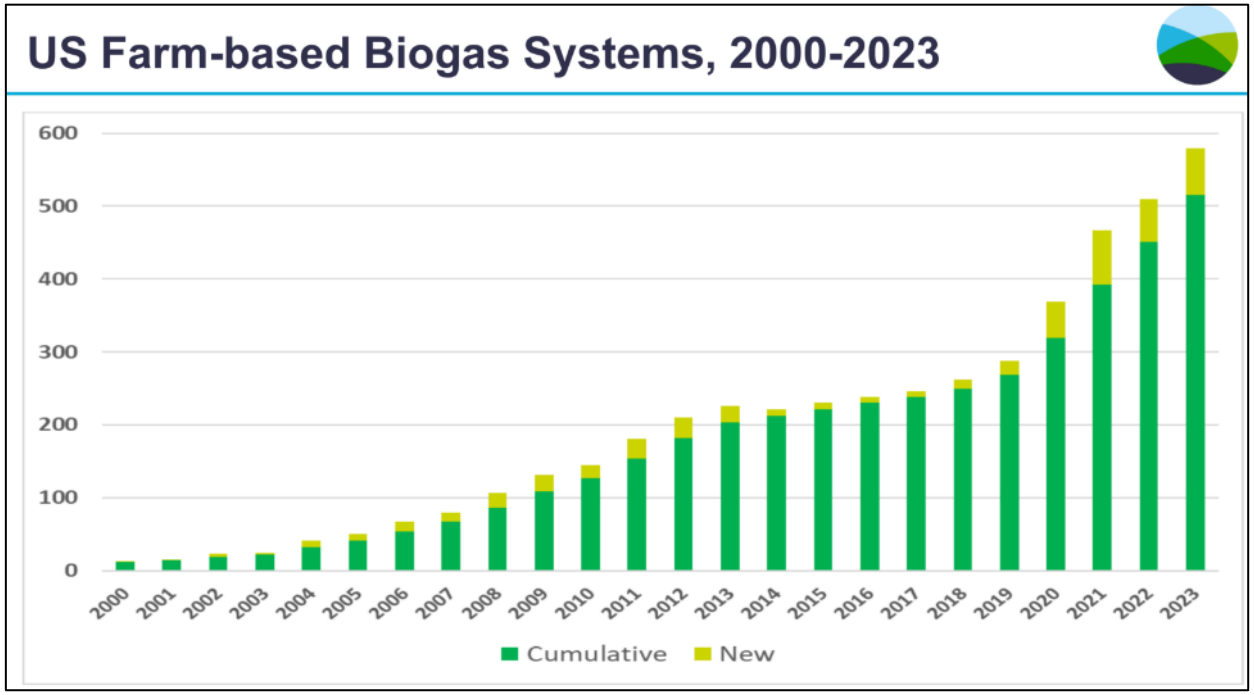
INFOGRAPHICS – COURTESY OF ABC







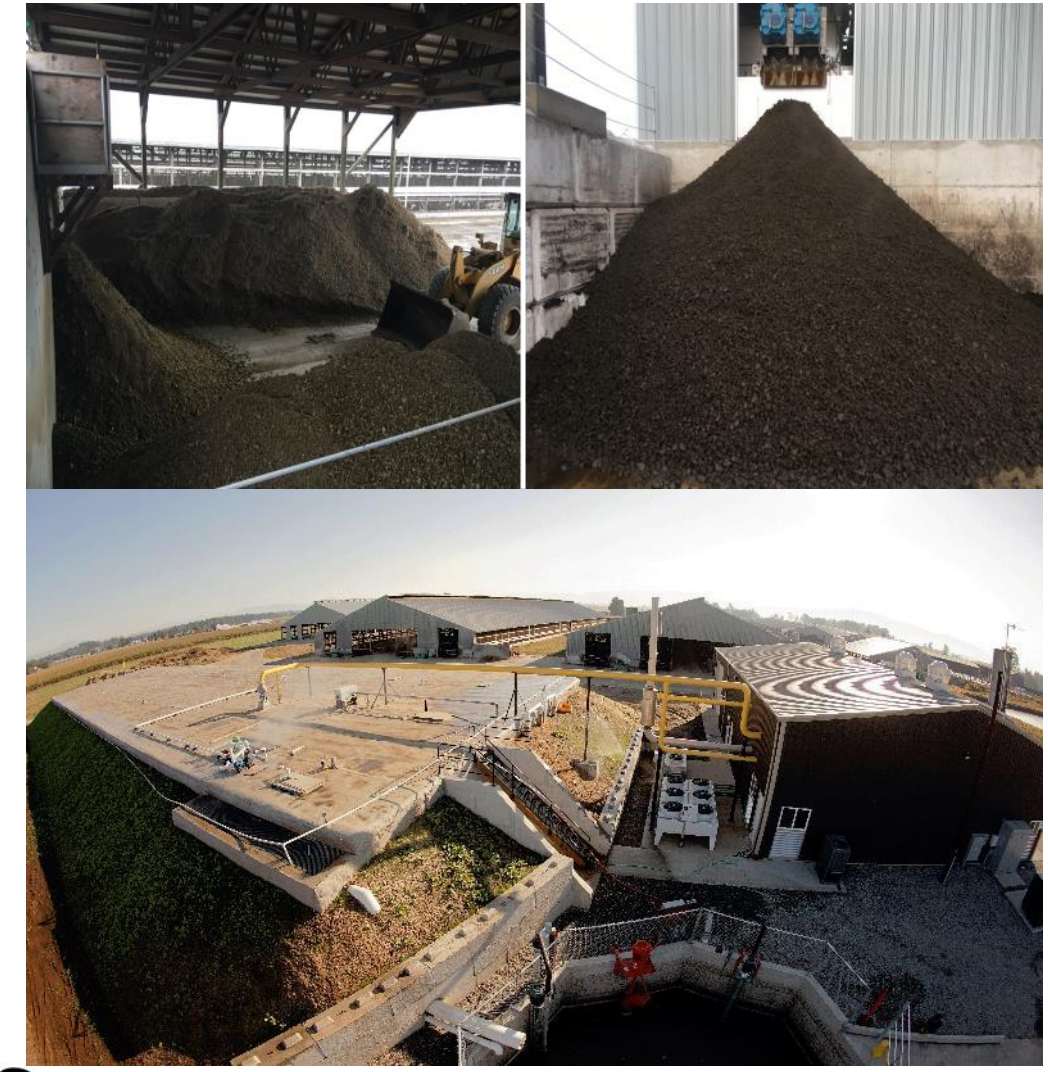




Key Facts to Know

- ✓ Digesters are expensive to construct and operate as well as complex accounting for credits, grants, etc.
- ✓ As such, many projects now developed by 3rd party financiers to cover and manage costs/complexity
  - ✓ We are seeing some dairies buck this trend and develop/monetize the project themselves
- ✓ Such projects require lease agreements, manure handling agreements, 10+ year future commitments in those agreements, and team-work to be successful
- ✓ Degree of profit sharing, payback timing, concerns with fluctuating market pricing, underwriting, who takes the financial burden, etc. are all points of negotiation.

1,200 milker, 145 SCFM co-biogas facility in Lynden WA– 4 million kWh per year



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FLUCTUATING ECONOMICS

LCFS 2-YEARS AGO + eRINS

Parameters	DAIRY RNG	DAIRY CHP	CODIGEST CHP
Holstein Wet Cow Equivalents (HWCE)	7,000	1,500	1,500
Manure Flow Rate (GPD)	245,000	52,500	52,500
% Co-digestion by Volume (%)	-	-	30%
Other Substrate Flow Rate (GPD)	-	-	22,000
Total Flow Rate (GPD)	245,000	52,500	74,500
Biogas Flow Rate (SCFM)	572	123	243
Estimated CI Score	**-220**	**-400**	**-120**
CH4 Content (%)	58%	58%	60%
RNG Pipeline Required BTU (BTU/ft3/RNG)	985	985	985
CH4 Recovery in Scrubber (% Saved)	97%	97%	97%
CH4 Content RNG Pipeline Required (%)	97%	97%	97%
System Runtime (%)	95%	95%	95%
Engine Efficiency (SCF biogas/kWh)		15	15
Value Commidity Gas ($/MMBTU)	$3.00	$3.00	$3.00
Electron PPA Price ($/kWh)		$0.05	$0.05
Price Tipping Fee ($/gallon)			$0.07
Value D3 RIN-100% ($/Credit)	$3.25	$3.25	$3.25
Value D5 RIN-100% ($/Credit)	$0.70	$0.70	$0.70
Value LCFS--100% ($/Credit) - OREGON	$180.00	$180.00	$140.00
Offtake Partner/Middlemen % Cut	25%	25%	25%
Output Results			
Annual RNG Output (MMBTU/year)	**163,238**		-
Power Production (kWh/year)	-	**4,081,858**	**8,076,140**
Monetary Results			
Commodity Gas/Electron	**$489,713**	**$204,093**	**$403,807**
D3 Federal RINs	**$6,221,578**	**$510,518**	**$599,736**
D5 Federal RINs	**$0**		
LCFS	**$9,506,051**	**$793,513**	**$176,657**
Tipping Fee	**$0**	**$0**	**$562,100**
Total	**$12,163,006**	**$1,508,124**	**$1,742,300**
GROSS REVENUE per MMBTU	**$74.51**	-	-
GROSS REVENUE per KW		**$0.37**	**$0.22**

At $50/MMBTU and $0.12/kWh – dairy greenfield projects are very tight. Of importance to adoption:

- **LCFS/RIN Credit Pricing**
- **EPA RVO Correct**
- **eRINS adopted**
- **ITC/PTC Renewal**
- **Miseducation Improved**

TODAY

Parameters	DAIRY RNG	DAIRY CHP	CODIGEST CHP
Holstein Wet Cow Equivalents (HWCE)	7,000	1,500	1,500
Manure Flow Rate (GPD)	245,000	52,500	52,500
% Co-digestion by Volume (%)	-	-	30%
Other Substrate Flow Rate (GPD)	-	-	22,000
Total Flow Rate (GPD)	245,000	52,500	74,500
Biogas Flow Rate (SCFM)	572	123	243
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Electron PPA Price ($/kWh)		$0.05	$0.05
Price Tipping Fee ($/gallon)			$0.07
Value D3 RIN-100% ($/Credit)	$3.25	$3.25	$3.25
Value D5 RIN-100% ($/Credit)	$0.70	$0.70	$0.70
Value LCFS--100% ($/Credit) - OREGON	$68.00	$68.00	$36.00
Offtake Partner/Middlemen % Cut	25%	25%	25%
Output Results			
Annual RNG Output (MMBTU/year)	**163,238**		-
Power Production (kWh/year)	-	**4,081,858**	**8,076,140**
Monetary Results			
Commodity Gas/Electron	**$489,713**	**$204,093**	**$403,807**
D3 Federal RINs	**$6,221,578**	**$0**	**$0**
D5 Federal RINs	**$0**	**$0**	**$0**
LCFS	**$3,591,175**	**$299,772**	**$45,426**
Tipping Fee	**$0**	**$0**	**$562,100**
Total	**$7,726,849**	**$503,865**	**$1,011,333**
GROSS REVENUE per MMBTU	**$47.33**	-	-
GROSS REVENUE per KW		**$0.12**	**$0.13**

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WHY MORE ADOPTION IN IDAHO THAN WASHINGTON

- ✓ Idaho dairies are at a larger scale more suited for RNG production, which is more economically attractive now. Large developers involved – Vitol, Shell, BP, Sevana, Clean Energy.
- ✓ Idaho invested in significant milk processing beyond fluidized milk which allows for new markets and potential for dairy industry growth.
- ✓ Dairies were innovative with processing investment, which made them open to digester innovation. Idaho Cattleman Association quite innovative and active. Early dairy adopters talk and spread the word.
- ✓ Local regulators, pipelines, companies, dairies have built experience, value-chains aiding adoption.

Conclusion

- ✓ Climate needs/goals which will only intensify will require innovation, renewable energy and methane mitigation – AD is well situated with the CH_4 molecule to meet these needs/goals via a variety of renewable energy pathways – Agricultural AD seen as $25 billion industry by 2032.

- ✓ AD industry blocked with inconsistent credit programs/pricing and federal/state policy. Until consistency of messaging and corresponding policy and legislative programs is achieved, industry will experience ebbs/flows and not achieve targets.

- ✓ Electrical pathway is the pathway for medium-sized dairies (1,000-3,000 milkers) but at present economics simply do not pencil – eRIN and other policy programs needed.

- ✓ Negative perceptions must be resolved through education – Climate, Renewables, Agricultural/Animal Industry, Digester Benefits, RNG/CNG stopgaps, etc.