MARKET CHALLENGES AND OPPORTUNITIES FOR DAIRY ANAEROBIC DIGESTION (AD) IN WASHINGTON STATE

Prepared by Energy Vision for Washington State

DECEMBER 2025

ENERGY VISION

Photo Source: USDAgov (Flickr Creative Commons)

Table of Contents

Introduction 1

Executive Summary 2

I. Background and Market Overview 6

II. Stakeholder Feedback 9

III. Policy Recommendations 15

- I. Direct Economic Support Options 15
- II. Broader Market Development Options 22
- III. Community Engagement 29

Appendix: A Comprehensive Analysis of the Barriers and Opportunities for the Dairy AD Industry in Washington 31

Introduction

Despite recent retrenchment by the current administration regarding climate and clean energy policy, findings from the global scientific community remain crystal clear – rapidly cutting economy-wide anthropogenic methane emissions is among the best levers we have to prevent the most catastrophic impacts of a warming planet. Why methane? Because, while methane is a "short lived" climate pollutant compared to carbon dioxide (which persists in the atmosphere for centuries), it is far more potent. Methane has 84-86x the global warming potential of CO2 over a 20-year timeframe. As a result, rapid cuts in methane over the next decade can have an outsized impact in slowing future warming.

Globally (and in the US), the major sources of methane are consistent. They include agriculture (primarily livestock), energy systems (oil, gas and coal) and organic solid waste (especially in landfills). These account for the vast majority of anthropogenic methane. Collectively, the Intergovernmental Panel on Climate Change (IPCC) estimates that methane emissions account for 40-45% of current warming since the industrial era began in 1850. In recognition of this, at COP26 in 2021, the Global Methane Pledge to cut methane emissions at least 30% by 2030 (relative to the 2020 baseline) was signed by over 150 countries, including the US.

In Washington State, the lion's share of total greenhouse gas (GHG) emissions (>80%) come from transportation (~40%), buildings (~25%) and electricity consumption (19.5%). While the State does not explicitly publish estimates of methane as a percentage of total GHG emissions, the combination of agriculture and organic waste – two of the largest sources of methane — account for over 11% of total GHG emissions. (This is based on the 100-year global warming potential (GWP); if using the 20-year GWP, methane's proportion of total emissions would be more than three times higher.)

While dairy manure is not one of the largest emitters in the State, every percentage point matters on the way to reaching the global methane reduction goal as well as Washington's climate goals of a 45% reduction in total GHGs by 2030, 70% by 2040, and 95% by 2050. The urgency of cutting methane specifically gives dairy manure management outsized importance, and, crucially, there are proven technologies and policy incentives to cut those methane emissions significantly. Using these, Washington now has a golden opportunity to make its dairy sector a leader in cutting methane.

Limited resources must be spent wisely on climate strategies that will deliver the greatest benefits at the lowest cost – and facilitating a buildout of anaerobic digesters to turn dairy manure (perhaps with food waste) into renewable energy and fertilizer is extremely cost-effective. California has done so with remarkable success, catalyzing the development of more than 120 dairy AD projects. Of note, building dairy digesters in California has been among the most cost-effective methane reduction options among all sectors in the state. California's Dairy Digester Research and Development Program (DDRDP) has provided partial grants to dairy digester projects, reducing 2.4 million tons of CO2 equivalent annually at the very low cost of about $9/ton abated (whereas the average cost of GHG abatement across California's 2023 Greenhouse Gas Reduction Fund was $101/ton.)

Executive Summary

- Washington's agricultural sector is vital to the state's economy, representing 6.9% of the State's total greenhouse gas footprint. Within the ag sector, the dairy industry is a key pillar, typically ranked in the top three (usually 2nd) in value of production amongst all agricultural commodities in the state.

- While dairy is a relatively modest contributor to the state's GHG emissions, much of the potent methane from the management of dairy manure (1.7% of total statewide emissions) can be captured in airless tanks or covered lagoons called anaerobic digesters (ADs) and used to produce renewable energy. ADs alone may provide incremental nutrient management benefits, which can be greatly enhanced when coupled with post-AD digestate processing technologies.

- Anaerobic digestion offers a proven, commercial option to manage a range of organic waste streams including livestock manure. Globally – especially in Europe – there are tens of thousands of AD systems operating today. In the U.S., excluding wastewater treatment plants, there are approximately 700 stand-alone AD facilities operating. Despite its potential and benefits, AD deployment in Washington has been severely limited in comparison to other states with significant dairy industries (CA, ID, WI, NY) due to various challenges, not all of which are necessarily unique to Washington.

- Of the roughly 250 dairy farms in Washington, a large majority are too small (having less than 700 cows) for the economics of on-site AD to be viable, as they don't produce enough manure to cover the significant infrastructure costs or generate enough return on investment. But even at the 80 dairies where ADs could theoretically work, there are currently many obstacles to their development.

- There are five operational ADs in Washington today, down from nine. And the 80 additional dairies deemed large enough have two options to consider: either build their own AD(s) or participate in multi-dairy centralized digester "hub and spoke" ventures. No dairy ADs have been built in Washington since 2015, although a handful of new projects have completed substantial development and may become operational in the next 12-18 months.

- Through surveys and direct engagement with Energy Vision for this study, close to 40 dairy farmers and 10 leading developers/investors voiced that while there is clear interest and untapped potential for dairy ADs, the status quo is far from appealing in Washington State at present.

    - Most WA dairy farmers have considered building ADs but have decided not to because the economics are seen as too risky. The top reasons were "lack of clear

financial returns" (70%), "upfront capital costs" (65%), and "ongoing maintenance costs" (55%).

- The top three financial incentives that farmers said would make ADs more attractive were "guaranteed purchase agreements for biogas or RNG" (74%), "capital cost subsidies" (61%), and "reduced regulatory hurdles" (57%).
- 76% of farmers were more inclined to explore or pursue ADs if a premium price for milk associated with on-farm sustainability enhancements were guaranteed.
- 71% of farmers were interested in learning more about AD adoption on their dairy farms.
- The overwhelming majority of developers saw two obstacles to dairy AD buildout in the U.S. as the biggest by far: market volatility for renewable energy credits (90%) and lack of certainty around carbon accounting and associated environmental attributes (60%).
- Most developers noted that three incentives would make AD adoption more financeable: guaranteed (fixed price, long term) offtake agreements for biogas or RNG (80%), capital cost subsidies (70%), and access to low-interest financing or loan guarantees (60%).
- Most developers support the multi-dairy hub and spoke model, some exclusively so. Meanwhile, 32% of the dairy farmers who responded to Energy Vision's survey said that they would be more inclined to pursue ADs if another dairy was involved, so the hub and spoke model has real (as yet untapped) potential in Washington.
- Developers emphasized the need for long-term policy stability, especially with an eye toward end markets and credit prices, since offtake is such a critical determinant of AD viability. Some developers stated that Clean Fuel Standard credit prices would have to rise to make additional dairy ADs viable.

- This report makes 10 recommendations for Washington policymakers that would facilitate dairy AD buildout with all the associated climate and environmental benefits.
- There are numerous options to deploy state funds strategically, including direct subsidies to partially offset very high digester capital expenditure (capex). Average capital costs for dairy AD projects range from several million dollars to $50 million and up, depending on scale and complexity. Energy Vision calculated that if all 80 candidate dairies of sufficient herd size in Washington were to build ADs, the cumulative capex would be about $1.2 billion. Washington has committed a small amount of funds toward digester grants, but this could be scaled up many times over, perhaps emulating California's very

successful Dairy Digester Research and Development Program (DDRDP), whose grants have covered between 10% and 50% of a dairy AD project's total capex.

- Other direct funding recommendations include support for digester operations and maintenance (via grants or property tax credits), as well as subsidies/incentives for dairy AD-to-renewable natural gas (RNG) pipeline interconnections, perhaps directly correlated with the lifecycle carbon intensity of RNG projects.

- Washington could also tap into its newly formed "Green Bank" to deploy Cap and Invest funds to provide low-interest financing and loan guarantees for dairy AD buildout. This could be a very simple and effective solution, as the funds would be paid back and redeployed for additional GHG reduction purposes down the line.

- Additional recommendations would foster more robust market development. Using Cap and Invest funds, the state could also create a feed-in tariff supporting all dairy biogas-to-electricity projects and all dairy biogas-to-RNG projects. This would be a long-term structural boost to all dairy RNG and dairy electricity projects, derived from the basic model that has supported immense digester buildout and growth in Europe over the past 20+ years.

- There is enormous potential for Washington to divert food waste to dairy ADs, in furtherance of the State's goal of cutting 75% of the current organic materials going to landfills by 2030. In fact, if all 80 candidate dairies were to "co-digest" the maximum 30% of the State's food waste with 70% manure, they could theoretically accept almost 1.9 million tons of food waste per year – much more than the 1.2 million tons that Washington generates annually.

- Average credit prices in Washington's Clean Fuel Standard (CFS) program have dropped precipitously from around $100/credit at the outset in August 2023 to $40 in June 2024 and around $28 in June 2025. This means that the program is not nearly as robust as it could be in driving demand for the cleanest fuels, especially net-carbon-negative RNG sourced from dairy manure. And the low credit prices and volatility in the CFS market combined with high upfront costs make for unclear financial returns – one of the biggest deterrents to dairy farmers and AD developers. While a recently passed law to deepen annual CFS targets may raise credit prices, the economics will likely remain challenging in the next few years. Through legislation, Washington could follow California's lead in adopting an Auto-Acceleration Mechanism in its CFS rules to stabilize credit prices at higher levels.

- Prioritizing new data center decarbonization via biogas-to-electricity and/or RNG could also be a promising path forward. This quickly growing industry is poised to change energy markets nationwide, including in Washington. Data centers and dairy ADs may very well be ideal partners, both seeking long-term fixed-price contracts for RNG or biogas-electricity. Data centers could easily soak up the entire dairy AD energy produc-

tion potential in Washington and still need much more. Their willingness to pay relatively modest premiums for small blends of either RNG or biogas-electricity could provide the market certainty and higher pricing necessary to drive major buildout of Washington's dairy AD sector by 2030, and the state can play a role in facilitating that.

- Water quality issues related to dairy farms and manure management are extremely important, both for the environment and for public opinion. Since ADs do not by themselves also recover nutrients or treat water quality from the digestate (what's left after the biogas is extracted), it is important to facilitate the installation of secondary infrastructure that addresses both. This will reduce soil/nutrient runoff going into waterways/groundwater, and use of the treated digestate as a soil amendment will lower GHGs relative to synthetic fertilizer production.

- Regulators and communities remain concerned about water quality issues related to dairy farms and manure management. There is widespread suspicion of large dairies attempting to greenwash the issue, and this often extends to anaerobic digesters on dairies and incentivizing biogas production and usage.

- By incentivizing the dairies adopting best practices for digestate treatment, the state could address one of the main sources of public concern about anaerobic digestion. Based on our research and outreach, the most promising path forward to gain community support is building dairy ADs *and* installing digestate treatment systems.

- Since there is widespread misinformation about dairy ADs and their climate impacts proliferating through communities, it is important to not only present the facts but to do so in a transparent, non-antagonistic way. There is a real need for open dialogue to share the facts – backed by credible third-party certifiers – about ADs, add-on digestate treatment systems, and impacts on local communities. This could be an ongoing educational effort mediated by state officials and independent non-profits to add credibility.

- In particular, a valuable strategy to gain local support for an AD facility is to establish Community Benefits Agreements. These are legal contracts that define the benefits a developer will provide to local governments or community groups in exchange for their support for a project; they are tailored to the community's needs, such as through annual payments, support for public works, etc.

- Not everyone will become a proponent of ADs, but enough may recognize the importance of addressing methane emissions from the sector and at least accede to ADs being a feasible part of the solution set moving forward, as the positive climate impacts of ADs are substantiated by the best available science and data.

Dairy is a critical part of Washington's economy.
(Photo Source: Karla Salp, Washington Department of Agriculture, Creative Commons)

I. Background and Market Overview

Washington's dairy industry is vital to the state's economy and agricultural sector. Although it is a relatively modest contributor to the state's GHG emissions, the potent methane from dairy manure management is still important to reduce as much as possible – and this can largely be addressed through proven solutions like anaerobic digesters (ADs). AD technology processes manure in airless tanks or covered lagoons, capturing the methane emitted by this organic waste so it does not escape into the atmosphere. Instead, the methane can be used to generate power or it can be refined into renewable natural gas (RNG.) ADs alone may provide incremental nutrient management benefits, but these benefits can be greatly enhanced when coupled with post-AD digestate-processing technologies.

Despite the benefits of ADs, deployment in Washington has been limited in comparison to major dairy states (CA, ID, WI, NY) due to various challenges, some of which are not necessarily unique to Washington. (These are explored in more detail in the following section, Stakeholder Feedback.)

A large majority of Washington dairies are too small for the economics of AD to be viable, based on the

Figure 1: Breakdown of All WA Dairy Farms by Number of Milking Cows

Number of Milking Cows	Number of Farms
1 to 199	98
200-699	62
700-1,699	50
1,700-2,699	15
2,700-4,699	16
4,700+	8
Total	249
Subtotal with at least 700	89
Already have ADs	9 (5 operational)
New potential ADs/ New hub and spoke participants	**80**

Source: WSDA Database of Licensed Dairies as of May 27, 2025

Manure anaerobic digesters are a proven solution to cut methane emissions.
(Photo Source: Pixabay; Creative Commons)

bare minimum theoretical threshold – as determined years ago by US EPA's AgSTAR program – of at least 500 milking cows (see Fig. 1 above). Smaller herds don't produce enough manure to cover the significant AD infrastructure costs or generate enough return on investment. Meanwhile, developers prefer considerably larger herd sizes, as noted in their responses in the following section. For reference, 39% of Washington dairies have under 200 milking cows and 64% have under 700 milking cows.

Washington has 80 dairy farms deemed theoretically large enough (for the most accurate data here we use WSDA's category of having at least 700 milking cows) to support their own AD(s) onsite or participate in multi-dairy AD projects via the "hub and spoke" model. Of these, 9 already have ADs, although 4 are not operational at present (see table below). Therefore, 80 additional dairy farms could build their own ADs or become part of centralized digester hub and spoke (or "dairy cluster") projects. If all 80 did so, and the existing ones were fully operational again, that would mean the percentage of Washington dairies involved in an AD project would rise from 3.6% today to almost 36%. There's also a possible upside if some of the state's 62 smaller dairies (with 200-699 milking cows) partner with other nearby smaller dairies or with a nearby large dairy on a centralized digester hub and spoke or cluster project that aggregates manure from multiple sites at a single central location. This approach is common in northern Europe, particularly in Denmark and Germany where the average dairy farm size is much smaller than the U.S.

Eight of the nine dairies with ADs in Washington use their biogas to generate electricity (or used to do so when their ADs were operational). At least two have installed cogeneration (combined heat and power; CHP) equipment, generating electricity and utilizing the heat produced in the process. Interestingly enough, none of these ADs were built within the last decade; all installations occurred during the "first wave" of U.S. biogas deployments between 2004 to 2015.

Only one of the nine ADs, the George DeRuyter & Sons Dairy Digester, produces renewable natural gas (RNG), a project developed by Promus Energy. The Promus Outlook Granger (POG) project uses the manure from roughly 5,500 dairy cows to create over 900,000 gasoline gallon equivalents (GGEs) per year of pipeline-quality RNG plus bio-fertilizers, and fiber

Figure 2: Breakdown of the 9 Existing ADs by Farm Size and Energy Output

Project Name	City	County	Start Year	Dairy Herd Size	Co-digestion	Biogas End Use
Operational						
Edaleen Cow Power, LLC Digester	Lynden	Whatcom	2012	2,500	Agricultural Residues; Beverage and Distillery Wastes; Dairy Processing Wastes; Fats, Oils, Greases; Food Processing Wastes; Food Wastes; Process Water; Slaughterhouses; Other Feedstocks	Electricity
Farm Power Rexville Digester	Mount Vernon	Skagit	2009	1,500	Food Wastes	Electricity
G DeRuyter & Sons Dairy Digester	Outlook	Yakima	2006 (converted from electricity to RNG in 2018)	5,500	Fats, Oils, Greases	RNG
Qualco Energy Digester	Monroe	Snohomish	2008	2,000	Food Wastes; Other Feedstocks	Electricity
Vander Haak Dairy Digester	Lynden	Whatcom	2004	1,000	Food Processing Wastes	Electricity -Cogeneration
Not Operational						
Blok's Evergreen Dairy, Inc	Lynden	Whatcom	2015	Unspecified in the 700-1,700 range	Unknown	Electricity (unknown if cogeneration)
Farm Power Lynden Digester	Lynden	Whatcom	2010	2,000	Food Wastes	Electricity - Cogeneration
Rainier Biogas Digester	Enumclaw	King	2012	1,500	Agricultural Residues; Beverage and Distillery Wastes; Dairy Processing Wastes; Fats, Oils, Greases; Food Processing Wastes; Food Wastes; Process Water; Slaughterhouses; Other Feedstocks	Electricity
Van Dyk Dairy Digester	Lynden	Whatcom	2011	Formerly 800	Dairy Processing Wastes; Food Wastes	Electricity

Source: AgSTAR, Promus Energy, Zero Waste Washington, Washington Geospatial Open Data Portal

products. It has an ultra-low carbon intensity score (-240 gCO2e/MJ), which is key for generating credits and making the project economics pencil out. The RNG travels through a dedicated project pipeline and interconnect facility to the existing interstate gas grid. The end-users are natural gas vehicles – transit buses, delivery vans, airport shuttles, garbage trucks — in West Coast states with clean fuels programs (California, Oregon, and Washington).

In addition, one AD project is under development using manure combined ("co-digested") with agricultural crop waste to ultimately produce RNG: Sunnyside RNG. Located in Sunnyside, WA (Yakima County), the project is estimated to produce 900,000 MMBTU of RNG per year. It was initially expected to come online in mid-2025, but that timeline has slipped. This project uses the "hub and spoke" model, which was developed in Europe where average farm size is much smaller, energy prices are much higher, and government has been more inclined to provide long-term certainty and favorable pricing. The hub and spoke model may offer an attractive approach highly relevant to Washington State. **It can feature either a centralized AD that receives manure from multiple dairies (as in the case of Sunnyside RNG with multiple digesters in a central facility), or a centralized processing and upgrading facility that receives biogas from multiple dairies that each have their own AD.** We explore the hub and spoke concept in greater detail below as well as in the Appendix.

II. Stakeholder Feedback

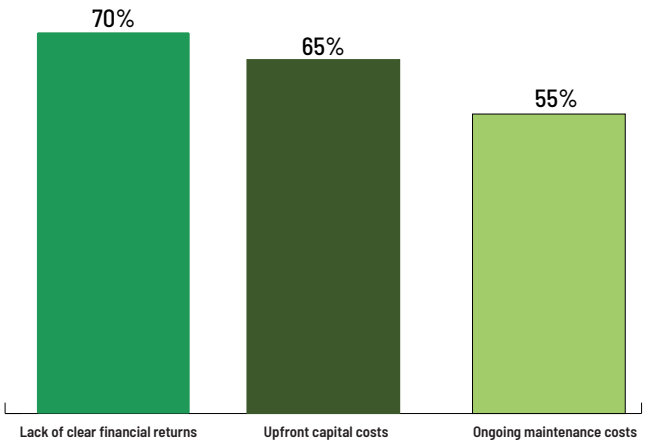
As part of our research, Energy Vision engaged extensively with relevant stakeholders, including dairy farmers, anaerobic digester (AD) developers, regulators, and communities. Below, we summarize the results of the detailed surveys we received from close to 40 farmers and 10 developers/investors. We also note the perspectives of regulators and communities.

Overall, farmers and developers voiced that while there is clear interest and untapped potential, the status quo is far from appealing in terms of AD adoption in Washington State. They cited major obstacles on numerous fronts. While individual responses varied, the common thread is that significant changes would have to be made in order to restart and accelerate the buildout of ADs in the Washington dairy sector.

What Percentage of Washington Dairy Farmers Have Considered Using ADs and Why They Decided Against It

- **73% of respondents have at some point considered using ADs on their dairy farm.** 62% spoke to an AD developer, although only 24% proceeded to do a financial feasibility study for installing one on their farm. And **none of these panned out**; there hasn't been a dairy AD installed in Washington State since 2015.

Figure 3: Top Three Reasons Farmers Rejected ADs After Consideration



  - **The most common reason for rejecting ADs – reported by 70% of respondents who had considered them – was "lack of clear financial returns."**
  - **This was closely followed by "upfront capital costs," as reported by 65% of respondents, and "ongoing maintenance costs," as cited by 55% of respondents.**
  - Other important but less cited reasons were "concerns about regulatory requirements" (45% of respondents), "market volatility for renewable energy credits" (35%), and "complexity of system maintenance" (30%).

- Anecdotally, other pertinent reasons include herd size being too small to make ADs financially feasible; a prevailing view that ADs are not sustainable without subsidies; and space constraints and insurance implications (one farmer noting a digester would take up too much space and be too close to other structures, making the farm uninsurable).

- Even for multi-property farmers who have installed an AD system on one farm and could in theory replicate that elsewhere, there is reluctance to do so. One farmer noted that they have one on their main dairy but are not sure if they could handle having another one on a secondary dairy.

What Would Make ADs More Attractive to Dairy Farmers

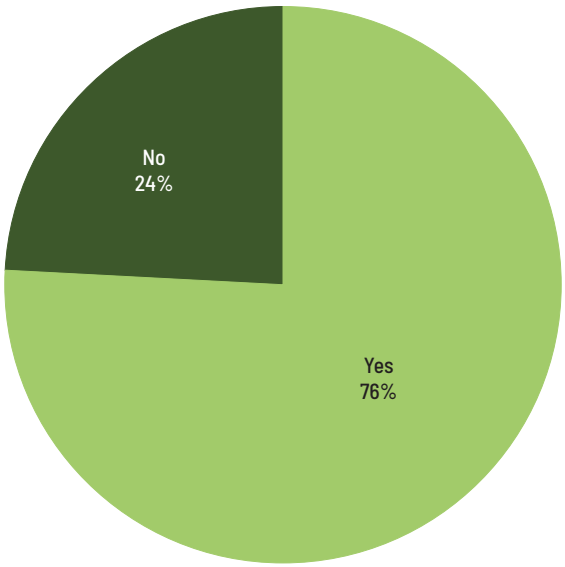
- The top three financial incentives that respondents said would make ADs more attractive were "guaranteed purchase agreements for biogas or RNG" (74%), "capital cost subsidies" (61%), and "reduced regulatory hurdles" (57%).

- Two other notable incentives were "access to low-interest financing" (44%) and "state-funded technical support" (39%).

Farmers reported they would be more receptive to sustainability measures if they would receive premium pricing for milk. Photo Source: Linnaea Mallette, Public-domainpictures.net (Creative Commons)

- 76% of respondents were more inclined to explore or pursue ADs if a premium price for milk associated with on-farm sustainability enhancements were guaranteed.

Figure 4: Question to Farmers –Would You Be More Inclined to Explore or Pursue ADs if a Premium Price for Milk Associated with On-Farm Sustainability Enhancements Were Guaranteed?



- The top three contractual agreements that would make dairy farmers more comfortable investing in ADs were "a long-term fixed-price contract for biogas/RNG sales" (32%), "a capital partner covering system costs" (27%), and "a third-party operator managing the system" (23%).

- Some dairy farmers indicated that they would be more inclined to pursue ADs if local partners were involved, specifically a nonprofit organization that works with farmers (42%), another dairy (32%), or a university extension office (21%).

Other Relevant Findings from Dairy Farmers

- **71% of farmers were interested in learning more about AD adoption on their dairy farms.**

- 75% would be willing to make a minority equity investment in an AD project to align financial

outcomes (assuming their other concerns were addressed, and the project were economically feasible).

- Almost 62% had a plan for farm ownership or management transition in the future; 27% were developing one; and close to 12% neither had a plan nor were making one.

- 75% had no preference for type of AD, while 20% preferred a plug flow AD, and just 5% favored a continuously stirred tank reactor (CSTR).

Developer Views of Obstacles and Opportunities for Building Dairy ADs

Energy Vision engaged with 10 developers who have evaluated or participated in more than 20 AD projects in Washington State collectively. This is typically a small portion of their overall portfolios of AD projects nationwide. They provided insights about developing ADs in general and particularities about Washington.

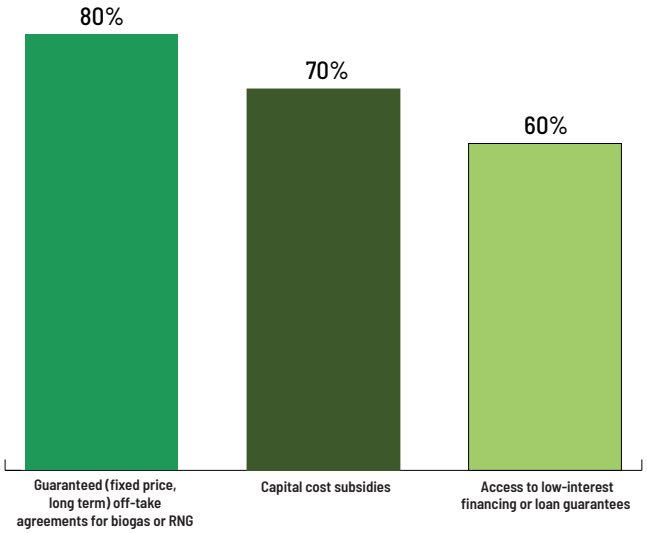
- **The overwhelming majority of developers saw two obstacles to dairy AD buildout in Washington State and across the U.S. as the biggest by far:**

    1. **Market volatility for renewable energy credits (90%); and**
    2. **Lack of certainty around carbon accounting and associated environmental attributes (60%)**

- Most developers noted that **three incentives would make AD adoption more financeable:**

    1. **Guaranteed (fixed price, long term) off-take agreements for biogas or RNG (80%);**
    2. **Capital cost subsidies (70%); and**
    3. **Access to low-interest financing or loan guarantees (60%).**

Figure 5: Top Three Incentives That Would Make AD Adoption More Financeable for Developers



- When asked what guarantees or contractual arrangements would make them more comfortable investing in or developing dairy AD projects, most developers (70%) agreed with all of the following options: **extension of the federal Biogas Investment Tax Credit, new high-value off-take markets comparable to premiums once seen under state Clean Fuel Standards, and e-RINS** (credits under the federal Renewable Fuel Standard for using biofuels to generate electricity for EVs) **or other approaches to re-incentivize biogas-to-electricity.**

Widespread Developer Focus on Hub and Spoke Model

- When asked what they thought the minimum number of milking cows required to seriously contemplate AD in the U.S. was, the lowest response was 1,500, with other responses fairly evenly distributed up to 20,000 as the *minimum*. This correlates with **most developers supporting the multi-dairy "hub and spoke" model**, where (in the case of a centralized digester) the per-farm number of milking cows matters less than the total number within the combined system. So some of the lower responses are likely for a single dairy, the middle-range responses of around 5,000 could be either way, and at least some of the upper responses of 10,000+ are likely assuming multiple dairies via a "hub

A compressed natural gas truck (whose fuel is stored in the large red tank behind the cabin) that could run on RNG as it transports manure. (Photo Source: [TruckPR; Flickr, Creative Commons)](#)

and spoke" digester model, either of a centralized digester or centralized processing facility.

- Developers emphasized that **the centralized digester hub and spoke model allows smaller dairies to participate in AD projects instead of only the largest ones**. As noted above, 32% of the dairy farmers who responded to Energy Vision's survey said that they would be more inclined to pursue ADs if another dairy was involved, so the hub and spoke model has real (as yet untapped) potential in Washington. In addition, for farms that face local nutrient management challenges, a potential added benefit of the centralized digester hub and spoke model is rooted in processing, recovering and utilizing these nutrients elsewhere.

- Some developers exclusively focus on the hub and spoke model due to the greater economies of scale available, even after factoring in the added logistical complexities. Anecdotally, they note that the hub and spoke model (either the centralized digester or centralized processing facility variant) can work depending on size of the dairies, feedstock composition (such as "co-digestion" of food waste and/or agricultural residue with the manure), distance between the component properties, proximity to a gas pipeline of attainable specifications where an interconnect is feasibly priced, state regulations (including for water usage), and offtake pricing.

- The model also depends on sufficiently high prices for Clean Fuel Standard credits gener-

ated by the renewable natural gas or electricity that these dairies ultimately produce. This is directly linked to the projects' carbon intensities, so that is another important factor developers consider. **Some developers stated that Clean Fuel Standard credit prices would have to rise to make additional dairy ADs viable**. (For reference, CFS credit prices – per metric ton of CO2e – have fallen from an all-time high of around $100 at the outset in August 2023 to near record lows of around $28 in June 2025.)

- Other pertinent feedback from developers included the **potential advantage of using trucks powered by renewable natural gas to transport manure from the participating dairies in a hub and spoke venture based on a centralized digester. RNG-powered trucks have much lower lifecycle greenhouse gas emissions and toxic air emissions than diesel trucks, and could run on RNG produced at the AD hub site**. One developer also noted that locating the central hub on industrial – versus agricultural – property may ease the permitting process.

- The economic and logistical challenges highlighted by key industry stakeholders are important but likely solvable. Arguably the **biggest technical challenge for dairy ADs is managing the liquid digestate** (what's left of the decomposed manure after the biogas is extracted), which depends partly on water use regulations. Other challenges include building infrastructure at dairies participating in a centralized digester hub and spoke venture to accommodate loading of manure (and potentially unloading of digestate if used on-farm), as well as driver availability and vehicle maintenance.

Developer Cost Estimates Per Milking Cow

- **The vast majority of developers – 67% – reported that the range of annual revenue necessary per milking cow to make a dairy AD project economic was $1,000 to $1,250.** Another 22% indicated a lower range of $750 to $1,000 per milking cow, while the remaining 11% indicated a higher range of $1,250 to $1,500.

- Developers were fairly split on projected building costs (hard and soft costs for digester, biogas utilization, etc.) per milking cow, with 33% putting $2,000 to $3,500, 44% putting $3,500 to $5,000, and 22% putting greater than $5,000. Unprecedented uncertainty around tariffs and the fate of various federal grants and incentives are a separate but related challenge at present.

Developer Preferences at Project Level

- **Nearly all developers opposed open feedlots, judging them to be impractical for manure collection. Flush collection also does not work with the centralized digester hub and spoke model if using trucks** to transport the manure (which would need to be dewatered prior to loading in order to maximize efficiency).

- **Almost all developers also said that sand bedding raises capex and opex significantly, in some cases to the point of being a deal breaker**. This is because sand in manure can severely damage AD performance, pumps, and nearly all manure pumping/piping systems. Therefore, sand/grit removal systems are required, adding cost and logistical complexity to a project.

- None of the developers "require" host farmers to invest capital in an AD project to better align financial outcomes, but most welcomed it.

Developer Recommendations

- **Developers emphasized the need for long-term policy stability, especially with an eye toward end markets and credit prices**, since offtake (and value associated with energy output) is such a critical determinant of AD viability.

- Likewise, **the dairy industry as a whole wants support and stability**, both to maintain rural livelihoods and keep consumer dairy prices down**. If the WA dairy industry contracts significantly, it could jeopardize existing and prospective ADs.**

- Some developers opined that **RNG usage should be incentivized or perhaps even mandated, to boost demand for dairy ADs while also achieving climate and public health benefits.**

- **Developers also pushed for both ADs and water quality treatment for the digestate to be incentivized**. The dairy sector has unique water challenges, particularly with nitrogen and phosphorous runoff issues. However, these can be managed more effectively as part of an AD project, by installing water quality management infrastructure to treat the liquid digestate. **Incentivizing both ADs and digestate treatment can alleviate the immediate water quality issues and long-term dairy viability.**

Perspectives of Regulators and Communities

The Washington State Department of Ecology oversees permitting and permit exemptions, and collaborates on technical assistance and enforcement. It also plays a role in promoting the re-use of food waste, in part through AD.

Permit-exempt ADs are required to comply with inspections by both the local jurisdictional health department as well as the Washington State Department of Agriculture (WSDA) under the Washington State Dairy Nutrient Management Act (DNMA). In practice, local health departments don't get involved unless there are complaints, but ADs are still under their joint authority, shared with Ecology and WSDA.

As long as AD operators are complying with all pertinent rules, in everything from manure storage to composition of co-digested organic waste to water quality issues, the regulators are content. **The State – and the Department of Ecology in particular – appear much more focused on promoting organics collection and diversion to meet the 2030 goal of 75% diversion of organic waste from landfills**; this is largely envisioned as being achieved by redistributing edible food and composting much of the rest. There has been considerably less emphasis on the valuable co-digestion of organic waste with manure at dairy ADs.

Regulators and communities remain very concerned about water quality issues as relates to dairy farms. This is a particularly hot button issue in the Lower Yakima Valley, where there has been a 15-year legal battle pitting environmental groups and Environmental Protection Agency regulators against several large dairies alleged to be polluting groundwater through application of manure to cropland and storage of manure in lagoons.

In terms of local community opinion, this legal saga over alleged water contamination plays an outsized role in overall impressions of dairy farms. There is a widespread perception that the large dairies are not acting in good faith and that any remedial efforts are merely attempts at greenwashing. This suspicion often extends to anaerobic digesters on dairies and incentivizing biogas production and usage. We encountered a lot of misinformation about dairy ADs and their climate impacts. Many non-farmer community members have already made up their minds on this matter despite a lack of real facts.

Since water quality remains such a high concern at the local/community level, typically more so than avoiding methane emissions from manure, the path forward that may have the most promise in terms of community acquiescence is emphasizing building ADs and installing digestate treatment systems that can cost-effectively recover nutrients, mitigate run-off, and promote good agronomy.

III. Policy Recommendations

Energy Vision conducted a comprehensive analysis of the barriers and opportunities open to the Washington dairy AD industry (see Appendix). This section expands upon the top 10 opportunities for Washington policymakers to facilitate an expansion of dairy anaerobic digestion in the state. These opportunities are grouped into three categories: **Direct Economic Support Options, Broader Market Development Options, and Community Engagement.**

I. Direct Economic Support Options

Anaerobic digesters (ADs) are expensive to build and maintain, while financial returns for dairy farmers are often unclear under current market conditions in Washington State. There are several ways in which the State can provide direct economic support for dairy AD projects, which would increase adoption of this technology and all the associated benefits – including greenhouse gas reductions, clean fuels production, distributed baseload energy generation, nutrient and odor management, and reduced watershed contamination.

Recommendation #1: Provide performance-based subsidies pegged to the most cost-effective strategies/projects on the basis of per-ton GHG abatement

Like many renewable energy technologies, up-front capital costs are often a major barrier to AD adoption on dairies in Washington (and elsewhere). The table below shows just how expensive the average capital costs alone are for dairy AD projects, ranging from $7 million to $50 million and up, depending on scale and complexity. If all 80 candidate dairies of sufficient herd size in Washington (700 milking cows) were to build ADs, the cumulative capex would be approximately $1.2 billion.

Figure 6: Estimated Capital Costs of Maximum Potential Dairy AD Buildout in Washington

Dairy Size (Milking Cows)	Number of Dairies in Washington	Estimated Average Capex per AD Project	Total Estimated Capex for All Dairies
700-1,699	50	$7 million	$350 million
1,700-2,699	15	$12 million	$180 million
2,700-4,699	16	$22 million	$352 million
4,700+	8	$50 million	$400 million
Subtotal: All dairies 700-4,700+	89		$1.282 billion
Minus those that already have ADs	-9		-$121 million
New dairies that could build ADs	**80**[1]		**$1.161 billion**

Source: Energy Vision. Dairy numbers are from Washington State Department of Agriculture Database of Licensed Dairies as of May 27, 2025; Cost estimates and calculations are from Energy Vision based on extrapolations of empirical project data from developers.

1 Farms with fewer than 700 cows are also interested in covered tanks and lagoon systems, even if energy recovery is not economically viable or attractive at this scale. The combination of "cover and flare" systems and rainfall exclusion (i.e. keeping rainwater from mixing with manure) offers significant potential benefits, including added manure storage capacity and reduced labor/costs associated with hauling or pumping water.

Figure 7: California Greenhouse Gas Reduction Fund's Three Most Cost Effective Programs

Program	Total Implemented ($M)	% of Total dollars	GHG redcns (1,000 MTCO2e)	% of Total tons	Cost per GHG ($/ton)
Sustainable Agricultural Lands Conservation Program	$ 168	1%	16,742	15%	$ 10
Dairy Digester Research and Development Program	$ 205	1%	22,295	20%	$ 9
Forest Health Program	$ 557	4%	20,753	18%	$ 27
Subtotal	**$ 931**	**6%**	**59,790**	**53%**	**$ 15**
87 remaining programs	*$ 14,458*	*94%*	*52,968*	*47%*	-
Total	**$ 15,389**	**100%**	**112,758**	**100%**	-

Source: Net-Zero California – Data analysis of cap-and-trade program investments

One model worthy of consideration is California's Dairy Digester Research and Development Program (DDRDP). In the past decade, the DDRDP has contributed funding to 138 dairy digester projects, with total program grants ranging from $11 million to $68 million annually. In its first six years (2015-2020), the DDRDP grants covered between 25% and 50% of a project's total capex (with grants capped at $3 million), including many at the upper end of that percentile range; in the past few years, the grants have been considerably lower, typically covering between 10% and 25% of a project's total capex (with grants capped at $1.6 million), although a few relatively inexpensive projects have received grants of up to 50%.2 Besides digester costs, the funding can be applied toward utilizing the biogas on-site to produce electricity, upgrading it to RNG, upgrading it to hydrogen fuel, or using it as a feedstock for liquid biofuels like sustainable aviation fuel or biomethanol. As of projects completed through 2024, 93% of the DDRDP projects have produced RNG, and the other 7% have produced electricity.

Since its inception, California's program has spurred major investments in dairy AD infrastructure and resulted in significant reductions in methane emissions. **Building ADs in the California dairy industry has been among the most cost-effective methane reduction options among all sectors in the state.**[3] The DDRDP projects have reduced total greenhouse gas emissions from manure management by more than 24 million metric tons of carbon dioxide equivalent (CO2e) over 10 years, or 2.4 million tons of CO2e annually. This represents an outsize climate impact at a very low cost (per ton) of abatement, estimated at approximately $9. For reference, the average cost of GHG abatement across the entire California 2023 Greenhouse Gas Reduction Fund (Cap & Trade) spending of $1.7 billion was $101/ton.[4] Through the Climate Commitment Act, the Washington legislature had initially appropriated $22 million for on-farm AD grants in the 2023-2025 period, but these required a 50% non-state match per applicant, and an attempt to secure federal funding as the match was unsuccessful. The legislature recently reduced the allocated AD grant funding to $13.2 million for the 2023-2025 period, some of which has already been spent. However, this amount could be scaled up in the future, and/or could conceivably cover a higher share of the per-applicant total costs.

Through the Climate Commitment Act, the Washington legislature had initially appropriated $22 million for on-farm AD grants in the 2023-2025 period, but these required a 50% non-state match per applicant, and an attempt to secure federal funding as the match was unsuccessful. The legislature recently reduced the allocated AD grant funding to $13.2 million for the 2023-2025 period, some of which has already been spent. However, this amount

2 https://www.cdfa.ca.gov/oefi/DDRDP/docs/DDRDP_Project_Level_Data.pdf

3 Net Zero California: Data analysis of cap-and-trade program investments. https://www.netzerocalifornia.org/blog/data-analysis-of-cap-and-trade-investments

4 CARB 2024 Annual Report: Cap-and-Trade Auction Proceeds. https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/cci_annual_report_2024.pdf

could be scaled up in the future, and/or could conceivably cover a higher share of the per-applicant total costs. **Even more important though, if the goal of the Climate Commitment Act (CCA) and associated Cap and Invest dollars is to fund a range of GHG reduction activities, providing greater transparency on how these funds are being allocated and what they have achieved may be key to the long-term success and public support for this program. One aspect of that effort would be to measure each CCA investment's relative cost-effectiveness ($/ton of carbon abated). In doing so, the State could allocate a specific share of CCA funds (e.g. 10-20% initially) to projects/technologies/initiatives achieving GHG reductions at or below $50/ton.**

As with California's experience, direct capex subsidies for dairy ADs would be very cost-effective in cutting methane emissions based on well-recognized lifecycle "carbon intensity" calculations. Manure management emissions accounted for 1.6 million metric tons of CO2 equivalent, or approximately 1.7% of Washington's total greenhouse gas emissions. Most of this – at least 75% – comes from larger farms (with at least 500 cows).[5] **To further illustrate this opportunity, $200-300 million in state subsidies (which could be spread out over a few years) that are strategically deployed to maximize impact could catalyze significant private capital to reach the full estimated ~$1.2 billion in capex for all feasible dairy ADs in Washington State rather quickly. This would cut manure methane emissions by at least 75%, meaning a reduction of at least 1.2 million metric tons of CO2e or at least 1.25% of Washington's total greenhouse gas emissions, making it a very cost-effective climate measure.**

Guardrails would be needed to ensure that taxpayer funds aren't misspent on non-viable projects. Dairies seeking such subsidies would have to apply with concrete plans proving their economic viability under a reasonable range of prices and conditions (i.e., with some margin to cope with variations in RNG prices.)

Potentially complicating dairy sector efforts to decarbonize, the Washington State Department of Ecology issued a final rule for the Clean Fuel Standard (CFS) in October 2025 that ends avoided methane crediting for manure RNG projects at most 20 years after projects become operational (including those that are already operational). In December 2024, Ecology had initially proposed a 15-year period of avoided methane crediting, but after various stakeholders submitted comments on how this approach would negatively impact current and future efforts to deploy new AD infrastructure, the final rule decided on two 10-year periods. However, there are nuances depending on when a manure RNG project became/becomes operational and its end-use.

- For projects that break ground between January 1, 2023, and December 31, 2029, the avoided methane crediting period is limited to two 10-year periods, counting from the quarter following Ecology approval of the CFS pathway application.
- For projects that break ground on or after January 1, 2030, crediting depends on end-use:
    - For RNG used as vehicle fuel (in compressed or liquefied natural gas engines), projects are eligible for avoided methane crediting only through December 31, 2040.
    - For RNG used to produce hydrogen, electricity, renewable diesel, alternative jet fuel, or alternative marine fuel, projects are eligible for avoided methane crediting through December 31, 2045.
- For already operational RNG projects (prior to January 1, 2023), the avoided methane period decreases incrementally from the starting year.
    - For a facility that started operations in 2022, the avoided methane crediting period is limited to 19 years.

5 According to 2022 USDA Census of Agriculture nationwide data, dairy farms with at least 500 cows accounted for approximately 7 million out of the total 9.3 million cows, or 75% of the total. Large dairy operations account for more methane per cow due to the use of lagoons for manure storage, whereas small dairies often apply manure directly to the land, where it mostly decomposes aerobically. However, this is generally not the case in Washington. Most dairy farms do not apply manure directly, especially west of the Cascade Range (high rain fall zone), where virtually all dairy farms have some storage designed to meet USDA NRCS standards, such as 4-5 months of manure, water and rainfall capacity.

- For a facility that started operations in 2021, the avoided methane crediting period is limited to 18 years.
- For a facility that started operations in 2020, the avoided methane crediting period is limited to 17 years. And so on.

- The updated CFS rule also allows avoided methane crediting for diverting organic material that would otherwise have been landfilled, provided it's above and beyond any regulatory requirements. Unlike manure RNG, there's no expiration date for this crediting. Depending on the particular feedstocks and digester operating conditions, this may lower the carbon intensity score of co-digesting diverted food waste with manure in dairy ADs and thereby earn more CFS credits (see Recommendation #7 below for more).

- Lastly, the rule also leaves open the possibility of curtailing the credits if regulations tighten. It stipulates that if "any law, regulation, or legally binding mandate requiring either greenhouse gas emission reductions from manure methane emissions from livestock and dairy projects or diversion of organic material from landfill disposal comes into effect during a project's crediting period, then the project is only eligible to receive avoided methane credits for the remainder of the project's current crediting period. The project may not request any additional avoided methane crediting periods."

Interestingly, California's Air Resources Board recently advanced and finalized a similar avoided methane crediting proposal for its Low Carbon Fuel Standard program, landing on a 20-year phase-out as of July 1, 2025. However, the CARB policy for the past 10 years (since inception of the California DDRDP program) has been that methane avoidance crediting/incentives were eligible for 30 years. Virtually all current digesters in California are now "grandfathered in" and eligible for an additional 30 years.

Aligning crediting mechanisms with project lifespans (typically 20-30 years for AD projects) is essential to securing private investment and maximizing long-term benefits. Beyond climate impact, these projects create skilled rural jobs, strengthen farm economic viability, and provide new revenue streams that can keep family farms in operation – while also advancing related key Washington State goals such as waste reduction and expanded renewable energy production. The updated CFS rule provides the 20-year stability that developers need if they can break ground on dairy RNG projects in the remaining years of the 2020s. This is a significant incentive for developers to build quickly, since if a project otherwise breaks ground in 2030 or later, it would only be eligible to receive avoided methane credits through 2040 for RNG used as vehicle fuel or through 2045 for RNG used to produce other fuels (hydrogen, electricity, renewable diesel, alternative jet fuel, or alternative marine fuel).

Recommendation #2: Provide state-funded technical support for AD operations and maintenance

AD technology is mature and well-proven, with tens of thousands of installations worldwide over the past 25+ years. However, proper AD operations and maintenance can be complex and highly technical, even for single feedstock systems (and especially for "co-digestion" of multiple organic waste streams). Many variables need to be taken into account to keep AD systems operating consistently and reliably. Co-digesting food waste, as is common throughout the state's existing dairy ADs, adds further complexity with regard to maintaining proper biological conditions. Certain types of food waste, like fats, oils, and grease (FOG), can significantly boost biogas production, but must be carefully monitored such that digester biology and operations are not compromised.

Washington could prioritize and subsidize technical support for AD operations and maintenance in the form of direct grants or tax credits. Successful digester operations are key to the scalability of an AD buildout. While most dairy farmers in the state may have no previous experience with ADs, there is a small core group of farmers and developers in Washington that have years of collective expertise. Leveraging this expertise can make it possible to cut high ongoing operating expenses and to reduce system downtime (which in turn maximizes the climate benefits of ADs). ADs are only effective in capturing methane if they are effectively operated and

Part of a natural gas pipeline. RNG can be injected into existing natural gas pipelines, although interconnections are quite expensive. Photo Source: Tony Webster, Flickr (Creative Commons)

maintained.[6]

Funding technical support for AD operations and maintenance could be separate from or related to a state prioritization of workforce development activities linked to digester operations. For example, Washington could partner with vocational schools or universities wherein the latter carries out AD technical support (training students with real world, marketable skills in the process) for dairies and the state provides some funding.

Recommendation #3: Incentivize/subsidize pipeline interconnection(s) of net-carbon-negative dairy RNG

Some dairies in Washington may be very favorable candidates for building ADs to produce RNG except that interconnection with the nearest gas pipeline turns out to be prohibitively expensive. **Because RNG from dairy manure is net-carbon-negative, it would be beneficial to the state's pipeline network to facilitate such interconnections and displace fossil natural gas as much as possible. Direct state subsidies for a dairy RNG interconnection are one option to do so.**

Washington could follow California's 2015 initiative, which established a Biomethane Monetary Incen-

6 Washington State University's Energy Program is deeply involved on this topic, with plans underway to develop and operate a digester project that could be utilized for various R&D and workforce development purposes.

tive Program[7] to help defray the high costs of RNG interconnections to utilities' pipeline grids. California's program is funded by the state's gas utility Cap-and-Trade auction proceeds, and has been repeatedly extended and allocated more funds. It now has an authorized total of $80 million (much of which has already been disbursed to eligible projects) and is currently in effect through December 31, 2026, although it will likely be extended again. The program directly funds up to 50% of the eligible interconnection costs, up to $3 million per interconnection for a non-dairy cluster and up to $5 million per interconnection for a dairy cluster. It includes an Incentive Reservation System, which allows the subsidy to be reserved during the development phase of a project and disbursed once the project is interconnected and operating. Eligible expenses to be reimbursed must meet certain general criteria limited to the design and construction of interconnections (and gathering lines within dairy clusters), excluding any RNG upgrading facility costs, for example.

Washington could adopt a similar program using Cap and Invest funds. And while California's program does not base its awards on the lifecycle carbon intensity of RNG projects, Washington could consider doing so. If the amount of the subsidy were to directly depend on the project's lifecycle carbon intensity, the projects with the greatest climate benefits would be the most incentivized. For example, if a typical interconnection costs $2 million, a dairy RNG project being used to produce transportation fuel in Washington with a carbon intensity (CI) of -100 gCO2e per Megajoule (MJ) could receive a 30% subsidy for the cost of interconnection, or $600,000, a project with a CI of -200 gCO2e per MJ could receive a 40% subsidy or $800,000, and so on. The amounts could be capped at maximum dollar awards in case the costs of a particular interconnection are exorbitantly high. And as in California's program, somewhat higher amounts could be authorized for dairy clusters (or centralized processing hub and spoke ventures) producing RNG given the added costs of gathering lines within the cluster.

A pipeline interconnection might also take excessively long (multiple years) to be approved, dampening developer interest in pursuing the project at all or unnecessarily delaying progress (meaning the climate benefits from methane capture are also delayed). One developer noted that low competition and regulation of interconnections for RNG in Washington significantly increases capex, but that this could be avoided through better oversight. Policymakers (and/or regulators) could streamline the state regulatory approval process for dairy RNG interconnections, and, to the extent possible under law, institute guardrails against utilities vastly overcharging for interconnections.

Recommendation #4: Prioritize new data center decarbonization via biogas-to-electricity and/or RNG

The very recent rush to develop and deploy data center infrastructure to fuel the AI revolution has significantly changed the outlook for energy markets in Washington and almost everywhere else in the country. **As a result, power demand projections for the next decade-plus have shifted drastically, such that capacity constraints are expected everywhere, including in Washington State.** Whether the "average" new AI data center requires 50MW, 500MW or more, it's unrealistic to think that dairy ADs or RNG more broadly will be a primary energy source. However, it's entirely possible that biogas-to-electricity or RNG projects can provide reliable, base-load energy when paired with intermittent renewables like solar or wind. The mechanics and economics associated with this approach are still being assessed, but there appear to be opportunities in this segment worth further exploration. Moreover, as the home to two of the "Magnificent 7" big tech companies leading the AI push – Microsoft and Amazon – Washington may be very well positioned to incentivize various data center decarbonization efforts.

With respect to dairy AD, data centers represent a new source of firm demand that could easily soak up the entire theoretical RNG production potential in the state. Nationwide, approximately 120 new natural gas-fired power plants with a total capacity of 80GW have been announced for completion by 2030. Not all will get built, but it highlights a major trend being driven primarily by insatiable energy demand from AI. On a more granular level, a 100 MW

7 Biomethane Monetary Incentive Program: https://www.socalgas.com/sustainability/renewable-gas/biomethane-monetary-incentive-program

Figure 8: Estimated Costs and Emissions Reductions in Sample Data Center Scenarios of RNG Usage

Scenario 1: 100 MW Data Center using 1% RNG (300k mmbtu/yr) and 99% fossil gas
• 29.7M mmbtu of fossil gas @ $5/mmbtu = $148.5M/yr • .3M mmbtu of dairy RNG @ $60/mmbtu = $18M/yr ◦ Total Energy Expenditure = $166.5M/yr ◦ Blended Cost per mmbtu = $5.55 (11% premium over fossil gas) ◦ Project Level Lifecycle Emissions Reduction via RNG = 103,000 MT CO2e per year
Scenario 2: 100 MW Data Center using 5% RNG (1.5M mmbtu/yr) and 95% fossil gas
• 28.5M mmbtu of fossil gas @ $5/mmbtu = $142.5M/yr • 1.5M mmbtu of dairy RNG @ $60/mmbtu = $90M/yr ◦ Total Energy Expenditure = $232.5M/yr ◦ Blended Cost per mmbtu = $7.75 (55% premium over fossil gas) ◦ Project Level Lifecycle Emissions Reduction via RNG = 514,000 MT CO2e per year
Scenario 3: 100 MW Data Center using 10% RNG (3M mmbtu/yr) and 90% fossil gas
• 27M mmbtu of fossil gas @ $5/mmbtu = $135M/yr • 3M mmbtu of dairy RNG @ $60/mmbtu = $180M/yr ◦ Total Energy Expenditure = $315M/yr ◦ Blended Cost per mmbtu = $10.50 (110% premium over fossil gas) ◦ Project Level Lifecycle Emissions Reduction via RNG = 1.03M MT CO2e per year

Source: Energy Vision calculations based on extrapolations of empirical project data from developers.

data center powered by natural gas as its primary fuel source would consume approximately 30 million mmbtu of gas per year. That's equivalent to nearly 25% of total US RNG production capacity (December 2024 data). **For comparison, a large dairy AD project might produce 300,000 mmbtu of RNG per year, or 1% of a single, moderately sized AI data center's energy needs.**

To further illustrate this opportunity, the table abovecontains some basic calculations around three RNG procurement scenarios: 1%, 5% and 10% blends of RNG used by a single data center.

This indicative scenario highlights the potential for big tech to drive major ag sector methane reductions (via dairy AD) by committing to very modest quantities of RNG and minimal premium pricing for blended supplies. Similarly, data center demand for renewable power (versus natural gas) may offer an alternative approach and significant demand for biogas-derived electricity. At relatively modest premiums for small blends of either RNG or biogas-electricity this quickly growing industry could provide the market certainty and premium pricing necessary to drive major buildout of Washington's dairy AD sector through the end of this decade (by 2030). However, at present, sufficient incentives or other drivers do not appear to exist to properly stimulate data centers to seriously pursue dairy RNG procurement.

Recommendation #5: Allocate a portion of "green bank" funds to expand access to low-interest financing and loan guarantees for dairy AD buildout

AD projects are expensive, and high interest rates

– and associated high costs of private capital – can eat away at profitability as well as prolong the time to recoup the investment. High-risk loans are also a deterrent to project development. However, an as-yet untapped solution may already be at hand. Washington's Cap and Invest program has generated over $3 billion dollars that are earmarked for redeployment in new projects to reduce greenhouse gas emissions.

There are different funding categories with varying eligibility criteria, but one of them is the Climate Commitment Account, whose objectives include "Supporting renewable energy technology and infrastructure" and "Investing in energy efficiency for industry and agriculture."

Washington's newly formed "Green Bank" could deploy Cap and Invest funds to provide low-interest financing and loan guarantees for dairy AD build-out. This represents a relatively simple and effective solution to facilitate further greenhouse gas reductions. **These funds would be paid back and could be redeployed for additional GHG reduction purposes down the line. (Cap and Invest funds could also be used for direct grants for dairy ADs or to fund feed-in tariffs for all dairy biogas-to-electricity and dairy biogas-to-RNG projects; see below.)**

Expanding access to low-interest financing and loan guarantees from the state green bank would take some risk out of the equation for AD developers, leading to more digesters being constructed. (Environmental Defense Fund published a useful analysis of funding models relevant to potential dairy climate solutions in November 2024, including loan guarantees.)

II. Broader Market Development Options

Recommendation #6: Create a feed-in tariff for all dairy biogas-to-RNG and dairy biogas-to-electricity projects and/or other incentives

Washington must produce more renewable electricity to meet its legally binding mandates, and the state could also cut its GHG emissions by ramping up net-carbon-negative RNG production to displace fossil fuels in transportation, heating and on-site power generation. Dairy biogas can help on both fronts, but the current market economics are not favorable: costs of production are too high, and the anticipated revenues from Clean Fuel Standard markets and RFS credits are currently too low.

Under Washington's Energy Independence Act (EIA), biogas is categorized as an eligible renewable energy source. Biogas producers generate renewable energy credits (RECs) which utilities can purchase to meet their renewable energy obligations under the EIA. Washington's Clean Fuel Standard (CFS) also allows biogas to generate electricity for electric vehicles specifically, earning credits depending on the project's lifecycle carbon intensity.

However, with abundant, clean, and inexpensive hydropower in the region, electricity prices are historically quite low in Washington so that even with the above credits, it is not attractive for developers to pursue biogas-to-electricity projects. Yet Washington's Clean Energy Transformation Act requires 80% of electric utilities' resources to be clean (renewable or zero-emissions) by 2030 and 100% clean by 2045. That is a major undertaking and biogas-to-electricity could play a larger role in making it happen if policymakers were to provide incentives.

Meanwhile, dairy RNG projects used for on-road transportation (as is the norm) typically earn revenue from three components: credits under the federal Renewable Fuel Standard, credits under a state's Clean Fuel Standard, and the commodity gas itself. However, credit prices in Washington's CFS program have plummeted in the past two years (see Recommendation #8: Amend Clean Fuel Standard program to stabilize credit prices at higher levels, below for more). The economics will likely remain challenging in the next few years even as Washington recently enacted a law deepening the emissions reduction targets of its Clean Fuel Standard by another 5% as of January 1, 2026 and another 4% beginning January 1, 2027, followed by an additional 3-4% each year from 2028 until 2038. These larger mandates may boost credit prices as more credits would be needed for compliance, but the law does not incorporate any specific mechanisms to stabilize credit prices at higher levels.

Beyond the CFS credits, the federal Renewable Fuel Standard credits and commodity gas value are typically not enough to make dairy RNG projects attractive for developers in Washington, absent subsidies

or other financial incentives. **Moreover, on-road vehicle demand for natural gas (and therefore RNG) – in Washington and nationwide – is modest at best with limited prospects for near-term growth, which is creating a supply-demand imbalance; i.e. the pace of RNG production growth is far greater than demand from on-road vehicles.**

Yet Washington has passed legislation mandating statewide GHG emission cuts of 45% by 2030, 70% by 2040, and 95% by 2050 with overall net-zero emissions (all relative to 1990 levels). Not all of that can feasibly come from electrification. Ramping up net-carbon-negative dairy RNG production to displace fossil fuels in transportation and heating can be a key complementary component, but it needs additional incentives and new sources of demand that offer the premium pricing necessary to build and operate AD infrastructure. In addition to the traditional on-road natural gas vehicle market, new high-value demand from prominent industries in Washington State could include:

- Data centers (see above)
- Biogas/RNG to electricity for EV-charging
- Aviation (local efforts are now underway to produce commercial quantities of Sustainable Aviation Fuel from RNG in Wallula Gap)
- Maritime (with major ports in Seattle and Tacoma, largely served by large global shippers with big decarbonization priorities – e.g. Maersk, CMA-CGM, Hapag-Lloyd – there is immense potential demand for low-carbon, non-petroleum alternatives to traditional marine fuel, especially bioLNG and biomethanol).

Feed-In Tariff

Using Cap and Invest funds, the state could create a feed-in tariff supporting all dairy biogas-to-electricity projects and all dairy biogas-to-RNG projects. The Department of Ecology lacks the authority to do so, meaning that legislation would need to be passed to pursue this option. If maximizing methane mitigation is a key priority, the feed-in tariff should be applied on an even playing field such that multiple dairy biogas utilization pathways are eligible, including on-site heat/power, RNG and emerging next-gen approaches; it would be a long-term structural boost to all dairy AD projects. (This is the basic model that has supported immense digester buildout and growth in Europe over the past 20+ years; electricity first and then RNG.)

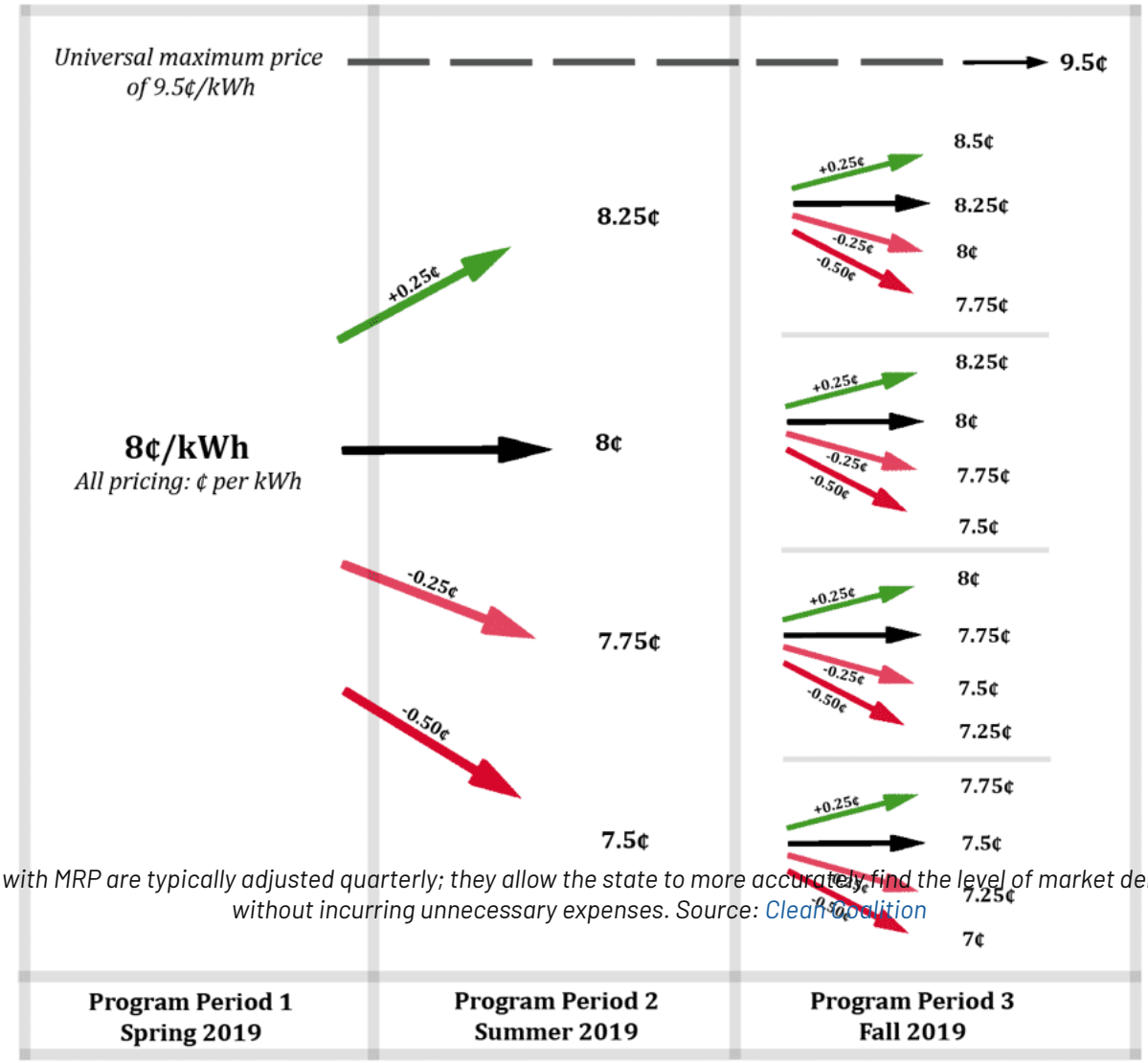
A state-funded feed-in tariff (FIT) would provide an above-market rate to dairy waste-derived energy producers over the duration of a long-term energy supply contract (which could be 15-25 years). The only US example of this approach we are aware of is Vermont's "Cow Power" program, which effectively offers a feed-in-tariff for dairy AD projects equating to approximately 18 cents per kilowatt hour. This kind of approach would provide the long-term economic support and predictability that developers crave and investors require. There are multiple options for how to structure a FIT, with the main considerations being whether it should be a fixed price or adjustable per unit of eligible energy supplied, and how much overall capacity should be eligible. These could be tailored to Washington's policy and budgetary preferences.

Arguably the best practice for a FIT is to base it on Market Responsive Pricing (MRP) rather than a fixed price per unit of energy. (The non-profit Clean Coalition has a helpful overview on this subject here as well as an in-depth guide.) A fixed price FIT can be sub-optimal: if it's too low, it would fail to drive developer interest, while if it's too high, it could trigger a rush of participants and end up costing the state more than necessary to catalyze the buildout. But MRP adjusts pricing based on demand, following a clearly defined set of parameters so that market actors can anticipate what will happen and there are no drastic changes. **They allow the state to more accurately find the level of market demand without incurring unnecessary expenses.**

FITs with MRP are typically adjusted quarterly (see example below). State policymakers would only need to set the initial price, the absolute maximum price, and how much capacity would be eligible for contracts awarded per quarter.

- For dairy biogas-to-electricity projects, a sample initial price (as in the example above) could be 8 cents per kilowatt-hour (kwh) and the eligible capacity for the first quarter could be

Figure 9: Sample Feed-In Tariff with Market Responsive Pricing



FITs with MRP are typically adjusted quarterly; they allow the state to more accurately find the level of market demand without incurring unnecessary expenses. Source: Clean Coalition

7.5 MW, while the absolute maximum price for the whole FIT could be 9.5 cents per kwh.

- If private actors issue valid bids to secure 60-100% of the eligible capacity at that initial rate, it would stay the same for new contracts awarded in the next quarter.
- If valid bids come in at 100-150% of the eligible capacity at the initial rate, then the price would decrease by a set increment (such as 0.25 cents per kwh) for new contracts awarded the next quarter.
- If valid bids exceed 150% of the eligible capacity at the initial rate, then the price would decrease by a larger set increment (such as 0.5 cents per kwh) for new contracts awarded the next quarter.
- If few bids come in at the initial rate (i.e., less than 60% of the eligible capacity), then the price would rise by a set increment (such as .25 cents per kwh) for new contracts awarded the next quarter.
- Depending on the results of the next round,

the price could stay the same, increase, or decrease; this process continues for all subsequent quarters to stay attuned to the market.

A similar setup could apply to dairy biogas-to-RNG projects. For example, the FIT with MRP could be available from the state on top of any other revenue sources to producers like Clean Fuel Standard prices, RFS credits, and the IRA 45z Clean Fuel Production Tax Credit. For example, an RNG FIT could set a baseline premium (additive to other available state and federal incentives and environmental attributes) at $5 per MMBTU, and a ceiling price of $10 per MMBTU, and adjust by $0.25 increments as needed per quarter, following the same or similar uptake thresholds as in the electricity example above.

Recommendation #7: Incentivize negative carbon intensity projects, the use of RNG to fuel trucks involved in dairy RNG projects, and co-digestion of food waste at dairy ADs

Washington could implement several other incentives for dairy biogas projects producing renewable energy:

- **7a: Provide a premium for negative carbon intensity projects.** Incentives could be directly correlated with lower carbon intensity scores so as to promote best practices in GHG mitigation. For example, the state could directly pay an additional premium to every project in the Clean Fuel Standard with negative carbon intensity, such as 1 cent (per MMBTU or per kwh) for every negative point, meaning a dairy RNG project with a carbon intensity of -150 gCO2e per MJ would receive $1.50 per MMBTU from the state on top of all other credits and revenue. If that dairy were able to implement additional sustainability measures and lower their carbon intensity to -215, then they would receive an additional $2.15 per MMBTU from the state once the new level was certified.

- **7b: Incentivize the use of RNG to fuel trucks involved in dairy RNG projects.** There could be an additional incentive for RNG use within dairy RNG projects when transport by truck is involved. Displacing diesel trucks with RNG trucks not only lowers lifecycle greenhouse gas emissions but also decreases emissions of criteria air pollutants, including nitrogen oxides (NOx) and fine particulate matter (PM2.5). Given the major climate and public health benefits (see Energy Vision's March 2025 report *A Path to a Healthier America: Ditching Old Diesel Trucks*), policymakers could establish a subsidy or tax credit to use dairy RNG produced on-site at a centralized digester hub and spoke venture in trucks to transport manure from the participating farms and digestate/fertilizer from the AD. This would also decrease the project's lifecycle carbon intensity score and improve air quality for the farm workers, drivers, and local communities. Additionally, it would drive increased local transportation sector demand, in turn ensuring a high-value in-state market for RNG.

- **7c: Prioritize co-digestion of food waste at dairy farms to better align with the State's ambitious organics recycling/landfill diversion mandates.** Co-digestion of food waste significantly boosts biogas production and creates much needed additional revenue for AD owners through tipping fees (for accepting external waste). Critically, co-digestion also helps achieve landfill diversion goals for organic waste, along with redistributing edible food and composting. This is a particularly salient issue in Washington, which aspires to be a national leader on landfill diversion and organics recycling. The State generates over 1.2 million tons of food waste annually (including both edible and non-edible food). Last year, Washington passed a law (HB 2301) to reduce food waste generation by 50% and divert 75% of organic material from landfills by 2030.

  While co-digestion seems like an ideal win-win option in furtherance of those goals, there is a rather illogical paradox wherein it has significantly worsened the carbon intensity (CI) score of dairy RNG projects (e.g. makes the CI "less negative" than RNG from manure alone), which in turn has reduced the number of Clean Fuel Standard (CFS) credits a project can generate. (The CI scores from co-digestion are highly variable because the digester conditions and therefore energy consumed and energy produced vary significantly depending on the feedstock type; the CFS accordingly uses set feedstock

Food waste that would be prime for co-digestion with manure in ADs. (Photo Source: Taz, Wikimedia Commons)

types to minimize the risk of significant CI variations.) The same paradox holds true at the federal level with the Renewable Fuel Standard, where RNG from straight manure earns more valuable D3 RINs while RNG from food waste (whether on its own or co-digested with manure) earns much less valuable D5 RINs.

At the state level, some of this paradox may finally change thanks to the updated CFS rule issued in October 2025 (see Recommendation #1), which expanded avoided methane credits to pathways using organic waste diverted from landfills. This means that the economics will likely improve for RNG projects sourced from manure with co-digested food waste that otherwise would have been landfilled. In any case, essentially all of the still operational ADs in Washington have already implemented co-digestion, because without it the economics would not be viable under current market and policy conditions.

According to the Washington State Department of Agriculture, there are over 275,000 milking cows in the State. As per the USDA Census of Agriculture 2022, dairies with 500+ cows account for just 27% of total dairies in Washington but have 91% of total milking cows and produce 91% of the milk.[8] The subset of all dairies with 500+ milking cows would have approximately 250,000 cows; subtracting the dairies with existing ADs means that the 80 candidate dairies highlighted in this report with at least 700 milking cows may therefore represent some 230,000 milking cows (conservatively rounded down). With each milking cow producing about 150 pounds of manure per day[9], that equates to 27.375 tons per year, or approximately 6.3 million tons of manure per year from all 230,000 milking cows collectively.

While there are nuances associated with the type of food waste being co-digested, the general rule of thumb is that food waste can comprise a maximum of 30% of the mixture in an AD, with manure accounting for the other at least 70%. (If it were all fats, oils, and grease, then the maximum percentage of food waste in the mix would be lower.)

As noted above, all the existing dairy ADs depend on co-digestion of food waste to stay afloat under current market and policy condi-

8 https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_1_State_Level/Washington/st53_1_017_019.pdf

9 https://cals.cornell.edu/pro-dairy/our-expertise/environmental-systems/manure-management

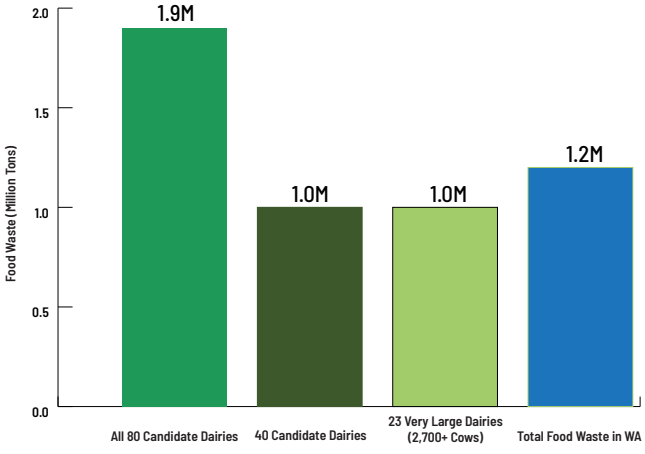
tions. As detailed below and depicted in the chart, there is enormous potential for Washington to divert food waste to ADs if all or some of the 80 candidate dairies were to build digesters and implement co-digestion.

- **If all 80 candidate dairies were to co-digest the maximum 30% of food waste, they could theoretically accept almost 1.9 million tons of food waste per year – much more than the 1.2 million tons that Washington generates annually.**

- **If only 40 candidate dairies of various herd sizes were to co-digest the maximum 30% of food waste, they could theoretically accept nearly 1 million tons of food waste per year – or almost 80% of the 1.2 million tons that Washington generates annually.**

- **Or, if only the 23 very large farms with 2,700+ cows that don't already have ADs were to build them and co-digest the maximum 30% of food waste, they could also theoretically accept almost 1 million tons of food waste per year – or 80% of the 1.2 million tons that Washington generates annually.**

Figure 10: Enormous Potential for Co-Digesting Food Waste at New Dairy ADs in Washington



Source: Energy Vision calculations, extrapolated from WSDA and USDA data on cow populations and Cornell Pro Dairy factors for manure generation per milk cow (see text above).

These calculations show that dairy AD co-digestion is a natural fit with Washington's other very important, ambitious environmental policy goal of diverting 75% of organic material from landfills by 2030. State investments in facilitating a dairy AD buildout could therefore not only catalyze methane capture and support the dairy industry but also help achieve the landfill organics diversion mandates coming up.

The aforementioned law that Washington passed last year, HB 2301, established (among other things) the Center for Sustainable Food Management to administer grants that support organics diversion. Eligible recipients include local governments, Native American tribes, nonprofits, and private businesses subject to the law. The grants must support education, outreach, technical assistance, indoor and outdoor infrastructure, transportation and processing infrastructure, or enforcement costs. The law also specifies that the Washington State Department of Ecology cannot require that local governments put up matching funds in order to receive assistance; rather, the Department of Ecology must provide assistance to each local government that demonstrates eligibility.

The law stipulates that Ecology must seek stakeholder input in the design, criteria, and logistics associated with each grant program, prioritizing according to EPA's wasted food scale (where anaerobic digestion with beneficial use of digestate is ranked after prevent food waste, donate edible food, and feed animals, but before anaerobic digestion without beneficial use of digestate, land application, and landfilling, incineration, or disposal down the drain).

Washington could prioritize co-digestion within the category of ADs with beneficial use of digestate for grants from the Center for Sustainable Food Management. Further support could potentially come from elsewhere, such as Cap and Invest funds, given the many environmental benefits of co-digestion, the need to reach the 2030 mandate, and the need to overcome the paradoxical financial disincentives for co-digestion.

Recommendation #8: Amend the Clean Fuel Standard program to stabilize credit prices at higher levels

Average credit prices in Washington's Clean Fuel

Standard program have dropped precipitously from around $100/credit at the outset in August 2023 to $40 in June 2024 and around $28 in June 2025. This means that the program is not nearly as robust as it could be in driving demand for the cleanest fuels, especially net-carbon-negative RNG sourced from dairy manure. **And the low credit prices and volatility in the Clean Fuel Standard market combined with high upfront costs make for unclear financial returns – one of the biggest deterrents to dairy farmers and AD developers.**

California's Low Carbon Fuel Standard has also experienced a glut of credits and a major drop in credit prices since 2022 as it overperformed expectations; this prompted the California Air Resources Board to adopt amendments to the program rules (effective as of July 1, 2025) that should help correct course. The main one regarding credit prices is an Auto-Acceleration Mechanism that would automatically advance the annual carbon intensity targets if decarbonization accelerates faster than anticipated, without the need for additional rulemaking. When well-defined, publicly available market metrics are met, then the Auto-Acceleration Mechanism would kick in, with impacts known in advance and understandable for stakeholders – i.e., more of the "bank" of excess credits would get used up and credit prices would rise.

Through legislation, Washington could adopt a similar Auto-Acceleration Mechanism or otherwise amend its Clean Fuel Standard statutory rules to stabilize credit prices at higher levels. Washington recently enacted a law deepening the emissions reduction targets of its Clean Fuels Program (effective as of July 27, 2025), including by another 5% as of January 1, 2026 and another 4% beginning January 1, 2027, followed by an additional 3-4% each year from 2028 until 2038. The law, HB 1409, includes several conditions that, if met, would allow Ecology to deepen the targets to a 55% reduction by 2038. These larger mandates may boost credit prices as more credits would be needed for compliance, but the law does not incorporate any specific mechanisms to stabilize credit prices at higher levels.

Recommendation #9: Prioritize the installation of nutrient recovery infrastructure for digestate and its use to replace synthetic fertilizers

Much of the focus on ADs revolves around biogas generation/energy recovery, since that has been a project's main revenue source since the inception of this US industry. It is important to recognize that ADs by themselves do not also recover nutrients or enhance water quality from the digestate – and water quality issues loom large in the public's attitudes toward large dairies (see Recommendation #10 below). Issues relating to manure management and digestate deserve major consideration and prioritization, since digestate management can be among the largest operational and environmental challenges associated with digesters, including in the dairy sector.

First and foremost, dairy farms have been regulated and monitored for decades to ensure manure is not contaminating waterways or groundwater. However, the combination of nutrient buildup and soil runoff/erosion during major rainfall events can still lead to nitrate and phosphate contamination. Any efforts to further minimize these runoff events should be prioritized.

While digestate (or even raw manure, in rare instances in Washington) can be land applied onsite at a farm, nutrient oversupply and seasonal restrictions on land application may mean that it would otherwise have to be trucked away for land application to fields off-farm (i.e., other agricultural operations), and in accordance with site-specific nutrient management plans.

Ultimately, digesters convert the nitrogen in manure into a form that is more susceptible to leaching into groundwater (if secondary treatment of digestate is not implemented). Therefore, it is critically important that land application is implemented in accordance with the best agronomic practices both on and off-farm. This more leachable form of nitrogen present in digestate, however, can also help displace the use of fossil-derived synthetic fertilizers commonly used in agriculture.

Proven technologies exist – and many more are being developed – today that can produce high-value phosphorous- and nitrogen-rich fertilizer from digestate that can displace the need for carbon-intensive synthetic fertilizers derived from petroleum. Depending on the specifics of the treatment process, fertilizer from dairy digestate may command

an additional price premium for being "natural" or "organic." This can be a sizable new revenue stream for a project while also eliminating the costs of trucking digestate offsite for disposal. This approach is actively being pursued by at least one of the dairy AD projects currently under development in the state.

By installing secondary digestate treatment systems, the digestate can be transformed from a liability into an agricultural asset while still meeting strict water quality regulations. Historically, and even today, the biggest obstacle hindering adoption of this technology appears to be that advanced nutrient recovery and water quality management infrastructure can add significant capex and opex to a project's overall costs. (There are multiple options depending on the technology and what nutrient end products are prioritized.) Meanwhile, robust markets for organic fertilizer or recovered nutrients are generally lacking or at least less certain, which has made it economically challenging to justify the added expense.

Given the major environmental benefits of nutrient recovery and water quality management infrastructure for digestate, Washington could incentivize their installation through subsidies, tax credits or other new market development initiatives. By rewarding the dairies adopting best practices for digestate treatment, the state could address one of the main sources of public concern about anaerobic digestion. **Based on our research and outreach, the path forward that may have the most promise in terms of community acquiescence is building dairy ADs and installing digestate treatment systems.**

Expanding demand for less carbon-intensive organic fertilizers, which typically require premium pricing, is key to creating a robust market, which would in turn provide much needed certainty that investments in digestate treatment can pay off. Given the existing organic farming sector in Washington, the state may be uniquely positioned to spur a regional market for digestate-derived fertilizer(s). Washington could also incentivize and facilitate the use of digestate fertilizers to replace petroleum-derived ones – for example, a farm could earn a climate smart agricultural property tax credit for each ton of digestate fertilizer used instead of a ton of synthetic fertilizer.

III. Community Engagement

Recommendation #10: Address community opposition to dairy operations broadly, including dairy biogas production, through open dialogue, greater transparency and data sharing backed by credible third-party certifiers

The dairy industry, especially large dairy farms, faces significant community opposition nationally, including in Washington. Much of this is based on suspicions of manure contaminating water supplies, above all in the Lower Yakima Valley, but it extends to dairy biogas production and the existence of large dairies in general.

In Washington, the interagency Clean Energy Siting Council recommends Community Benefits Agreements (CBAs), legal contracts defining what benefits a developer will provide to local governments or community groups in exchange for their support for a project. These can help mitigate local concerns and make the project more impactful by tailoring the benefits to the community's needs, such as through annual payments, support for public works, and so on (CBAs are a major priority of Environmental Defense Fund). CBAs are most impactful when there is a third party organization to provide legal support for community groups (as well as science data) to ensure communities know what they are signing up for (and what the risks are). As noted previously, communities are more likely to acquiesce to a buildout of dairy ADs if they also include digestate treatment systems. State and local officials could raise awareness of Community Benefits Agreements, perhaps supplemented by a publicly funded outreach.

Since there is widespread misinformation about dairy ADs and their climate impacts proliferating through communities, it is important to not only present the facts but to do so in a transparent, non-antagonistic way. There is a real need for open dialogue to share the facts – backed by credible third-party science/certifiers – about ADs, digestate treatment systems, and impacts on local communities (including the existence of Community Benefits Agreements). This could be mediated by state officials and independent non-profits to add credibility.

Dairy is a key pillar of Washington's economy – but without support, its future is at risk. (Photo Source: USDAgov; Flickr, Creative Commons)

There are numerous venues to hold such dialogue, including town hall gatherings with mutually agreed upon, respectful rules of conduct; webinars with experts and Q&A; tours of existing dairy ADs; invitation-only roundtables with key stakeholders; conferences; and informational booths such as at county fairs. Large venues such as rallies or rowdy town halls without mutually agreed upon, respectful rules of conduct would likely be ineffective or counterproductive, as dairy critics could show up to fire up their base in protest rather than listen to what the experts have to say with an open mind or be seen as conceding in any way.

Some critics are unlikely to change their minds about dairy ADs – but others may be more receptive upon learning the facts about the climate impacts of dairy ADs, the effectiveness of digestate treatment systems, and the importance of the dairy sector for the state's economy and for keeping consumer staples at affordable prices. Regardless, ongoing education, communication and engagement is essential. Not everyone has to become a proponent of ADs, but enough have to recognize the importance of addressing methane emissions from the sector and at least accede to ADs being a feasible part of the solution moving forward. We believe this is an achievable goal, as the climate impacts of ADs are substantiated by the best available science and data.

Despite varying degrees of community level and environmental justice concerns and opposition to dairy farms (and dairy AD systems by extension), the State can play an important positive role in facilitating education and engagement. Arguably the biggest risk factor is that Washington's dairy industry feels unwelcome and unwanted in the state. While this may be the preferred outcome for certain opposition groups, the likely outcome is not that these farms/farmers disappear altogether. Instead, they are much more likely to relocate to other states with more favorable conditions (e.g. Idaho, South Dakota, Kansas, Texas, etc.), in turn uprooting a long-term central pillar of Washington's agricultural economy.

Appendix: A Comprehensive Analysis of the Barriers and Opportunities for the Dairy AD Industry in Washington

Big Picture Economic and Regulatory Barriers

1. Barrier: Unclear financial returns, given high upfront costs and low credit prices and volatility in the Clean Fuel Standard market

- **Potential Solution: Capital cost subsidies**

  High capex is a major barrier to AD adoption on dairies in Washington (and elsewhere). One option worthy of consideration is adopting a statewide version of California's Dairy Digester Research and Development Program (DDRDP). In the past decade, the DDRDP has contributed funding to 138 dairy digester projects, with total program grants ranging from $11 million to $68 million annually. The DDRDP grants typically cover between 10% and 25% of a project's total capex. Besides digester costs, the funding can be used for using the biogas on-site to produce electricity, upgrading it to RNG, or upgrading it to hydrogen fuel, among other options. 93% of the DDRDP projects have produced RNG, and the other 7% have produced electricity.

  The program has been extremely successful: building ADs in the California dairy industry has been by far the most cost-effective methane reduction option among all sectors in the state. The DDRDP projects have reduced total greenhouse gas emissions from manure management by more than 24 million metric tons of carbon dioxide equivalent over 10 years, or 2.4 million annually.

  Through the Climate Commitment Act, the Washington legislature had initially appropriated $22 million for on-farm AD grants in the 2023-2025 period, but these required a 50% non-state match per applicant, and an attempt to secure federal funding as the match was unsuccessful. The legislature recently reduced the allocated AD grant funding to $13.2 million for the 2023-2025 period, some of which has already been spent. However, this amount could be scaled up in the future, and/or could cover a higher share of the per-applicant total costs than 50%.

- **Potential Solution: Guaranteed (fixed price, long term) offtake agreements for biogas or RNG**

  An ideal way of sidestepping volatile or historically low prices, such as those of credits in the Clean Fuel Standard program, is to sign long-term fixed-price offtake agreements for biogas or RNG. A guaranteed long-term supply at a mutually acceptable price would be a major boon for dairy AD developers, providing not just value but the necessary stability and guaranteed cash flows necessary to get projects financed as well.

  One option with theoretical potential in WA is to link dairy RNG production with new data center demand. Power-hungry data centers are proliferating and increasingly building their own electricity generation facilities. Many of these power plants are likely to run on fossil natural gas for lack of near-term access to the electric grid and years-long queues to gain utility approval. But sustainability is still an important consideration, so the data centers may be willing to pay a premium for RNG to fuel these power plants – and to know that the supply will still be there for them for many years at an acceptable price. (Data centers' concerns about the electric grid's capacity and priorities during outages mean they may prefer the certainty of RNG supplies and their own electric generation facilities over the possibility of buying electricity generated from dairy biogas.)

- **Potential Solution: Tweak Clean Fuel Standard program to stabilize credit prices at higher levels**

  Average credit prices in Washington's Clean Fuel Standard program have dropped precipitously from around $100/credit at the outset in August 2023 to $40 in June 2024 and just under $29 in April 2025. This means that the program is not nearly as robust as it could be in driving demand for the cleanest fuels, especially net-carbon-negative RNG sourced from dairy manure.

  California's Low Carbon Fuel Standard has also experienced a glut of credits and a major drop in credit prices since 2022 as it overperformed expectations; this prompted the California Air Resources Board to adopt amendments to the program rules that should help correct course. The main one regarding credit prices is an Auto-Acceleration Mechanism that would automatically advance the annual carbon intensity targets if decarbonization accelerates faster than anticipated, without the need for additional rulemaking. When well-defined, publicly available market metrics are met, then the Auto-Acceleration Mechanism would kick in, with impacts known in advance and understandable for stakeholders – i.e., more of the "bank" of excess credits would get used up and credit prices would rise. Through legislation, Washington could adopt a similar Auto-Acceleration Mechanism or otherwise amend its Clean Fuel Standard rules to stabilize credit prices at higher levels. Washington recently enacted a law deepening the emissions reduction targets of its Clean Fuels Program (effective as of July 27, 2025), which may boost credit prices as more credits would be needed for compliance, but the law did not incorporate any specific mechanisms to stabilize credit prices at higher levels.

- **Potential Solution: Guaranteed premium price for milk associated with on-farm sustainability enhancements**

  Individual dairies almost always sell their milk to a co-op or larger entity which markets it to consumers. Milk is a widely produced commodity and there is tremendous competition that keeps prices low for consumers. But just as there is a strong market for organic milk at higher prices, some consumers may be willing to pay a little more to buy milk from a co-op/company that is making real efforts to implement climate-friendly measures like installation of ADs and water quality treatment for digestate with nutrient recovery.

  Even 5 or 10 cents more per gallon of milk associated with such measures could be passed back to dairies to provide significant support for ADs, given the enormous volumes of milk produced. A typical dairy cow produces about 2,695 gallons of milk per year. A $0.05 sustainability premium per gallon would be about $135 per cow annually, and which for a sample herd of 2,000 milking cows would be $270,000 more per year. A $0.10 sustainability premium per gallon would be about $270 per cow annually, and which for a herd of 2,000 milking cows would be $540,000 more per year. This could tip the scales to making an AD project financially viable. As noted above, 76% of dairy farmers surveyed said they would be more inclined to explore or pursue ADs if a premium price for milk associated with on-farm sustainability enhancements were guaranteed.

- **Potential Solution: Create new, high-value, local off-take markets comparable to premiums once seen under state Clean Fuel Standards**

  Washington could create new local offtake markets to incentivize dairy ADs and other on-farm sustainability measures without relying on the Clean Fuel Standard. These new markets could have price floors and/or auto-adjustment mechanisms built in to keep credit prices relatively high. Options include a digestate-derived fertilizer market, an AD carbon capture market, a biogas as feedstock for sustainable aviation fuel market, and so on.

2. Barrier: High ongoing opex and system complexity

- **Potential Solution: State-funded technical support for AD operations and maintenance**

  AD technology is mature and well-proven, with tens of thousands of installations worldwide over the past 25+ years. However, proper AD operations and maintenance can be complex and highly technical. Many variables need to be taken into account to keep the biogas production at optimal levels. Co-digesting food waste, as is common throughout the state's existing dairy ADs, adds further complexity with regard to its composition.

  Dairy farmers who have no previous experience with ADs will either need an external operator or regular technical support. To cut opex and reduce system downtime (which in turn maximizes the climate benefits of ADs), Washington could subsidize technical support for AD operations and maintenance, separate or related to a focus on workforce development activities linked to digester operations.

3. Barrier: Regulatory complexity

- **Potential Solution: Reduce regulatory hurdles for dairy ADs**

  ADs are broadly regulated by the Department of Ecology, with many very specific requirements in all areas ranging from design to feedstock composition to digestate testing. There are also many reporting requirements throughout the initial construction process and once an AD is operational. Additionally, there are regulatory exemptions for some ADs, depending on size and co-digestion of a certain range of food waste relative to manure, where operational complexity can be reduced. If not seeking an exemption, developers can get the typical solid waste permit for an AD and operate it with greater complexity to achieve the highest biogas potential. (See here for the full regulations.)

  Overall, dairy farmers perceive this as being a lot to handle. Some aspects could be streamlined to reduce regulatory complexity and the time it takes farmers and AD operators to comply, while still maintaining safety and environmental protection. Follow-up surveys of what regulations dairy farmers find most onerous or inefficient could inform such efforts.

4. Barrier: High-interest financing and high-risk loans

- **Potential Solution: Expand access to low-interest financing and loan guarantees**

  AD projects are expensive, and high interest rates can eat away at profitability and prolong the time to recoup the investment. But an as-yet untapped solution may already be at hand. Washington's Cap and Invest program has generated over $3 billion dollars that are earmarked for redeployment in new projects to reduce greenhouse gas emissions.

  There are different funding categories with varying eligibility criteria, but one of them is the Climate Commitment Account, whose objectives include "Supporting renewable energy technology and infrastructure" and "Investing in energy efficiency for industry and agriculture."

  Using Cap and Invest funds through this channel to provide low-interest financing and loan guarantees for dairy AD buildout could be a very simple and effective solution to facilitate further greenhouse gas reductions. (Cap and Invest funds could also be used for direct grants for dairy ADs or to

fund feed-in tariffs for all dairy biogas-to-electricity and dairy biogas-to-RNG projects; see Barrier #6 and Potential Solutions below.)

5. Barrier: Lack of certainty around carbon accounting and associated environmental attributes

- **Potential Solution: Tweak laws and regulations to provide long-term certainty about carbon accounting and associated environmental attributes**

  The federal level is not the focus of this report, but it contributes to a lack of certainty around carbon accounting and associated environmental attributes. We note that a long-term extension of the federal Biogas Investment Tax Credit (which required biogas projects to start construction by the end of 2024) would greatly help in providing the stable economic support that AD developers seek.

  At the state level, there was considerable uncertainty earlier this year about whether the Department of Ecology would retain or phase out counting avoided methane emissions in Clean Fuel Standard calculations of carbon intensity. The final rule issued in October 2025 allowed the continuation of avoided methane crediting (generally for two 10-year periods), which was a more market-friendly change from the initially proposed 15-year period. But the issue was still up in the air during our survey period, so the responses reflect widespread concern about it (as well as carbon accounting in the U.S. more broadly).

6. Barrier: Insufficient incentives for biogas-to-electricity or biogas-to-RNG under current market conditions and uncertainty

- **Potential Solution: Expand incentives for biogas-to-electricity**

  Under Washington's Energy Independence Act (EIA), biogas is categorized as an eligible renewable energy source. Biogas producers generate renewable energy credits (RECs) which utilities can purchase to meet their renewable energy obligations under the EIA. Washington's Clean Fuel Standard also allows biogas to generate electricity for electric vehicles specifically, earning credits depending on the project's lifecycle carbon intensity.

  However, with abundant clean and inexpensive hydropower in the region, electricity prices are generally so low in Washington that even with the above credits, it is not attractive for developers to pursue biogas-to-electricity projects. Yet Washington's Clean Energy Transformation Act requires 80% of electric utilities' resources to be clean (renewable or zero-emissions) by 2030 and 100% clean by 2045. That is a major undertaking and biogas-to-electricity could play a larger role in making it happen – if policymakers were to provide incentives (for example directly correlated with lower carbon intensity scores), or to otherwise amend regulations regarding credits under the EIA and Clean Fuel Standard to improve project economics. For example, the state could pass legislation providing feed-in tariff support from Cap and Invest funds for all dairy biogas-to-electricity projects on an even playing field so as to not pick winners.

- **Potential Solution: Create additional incentives for RNG production and usage**

  Incentives for RNG production and usage would provide an impetus for building more dairy ADs. RNG made from dairy manure is net-carbon-negative on a lifecycle carbon accounting basis. As

with the biogas-to-electricity potential solution above, policymakers could provide subsidies (for example directly correlated with lower carbon intensity scores) or otherwise tweak rules governing credits under the Clean Fuel Standard to improve dairy manure-to-RNG project economics. For instance, Cap and Invest funds could be deployed as feed-in tariff support for all dairy biogas-to-RNG projects on an even playing field so as to not pick winners.

Displacing diesel trucks with RNG trucks not only lowers lifecycle greenhouse gas emissions but also decreases emissions of criteria air pollutants like nitrogen oxides (NOx) and fine particulate matter (PM2.5). Given the major climate and public health benefits (see Energy Vision's March 2025 report *A Path to a Healthier America: Ditching Old Diesel Trucks*), policymakers could establish a new incentive (such as a subsidy or tax credit) to use dairy RNG produced on-site at a centralized digester hub and spoke venture in trucks to transport manure from the participating farms and digestate/fertilizer from the AD. This would also decrease the project's lifecycle carbon intensity score and improve air quality for the farm workers, drivers, and local communities.

7. Barrier: Community opposition to dairy broadly, including dairy biogas production

- **Potential Solution: Open dialogue sharing the facts backed by credible third-party certifiers, potentially mediated by state officials and other independent non-profits**

  The dairy industry, especially large dairy farms, face significant community opposition nationally, including in Washington. Much of this is based on suspicions of manure contaminating water supplies, above all in the Lower Yakima Valley, but it extends to dairy biogas production and the existence of large dairies in general.

  Since there is widespread misinformation about dairy ADs and their climate impacts proliferating through communities, it is important to not only present the facts but to do so in a transparent, non-antagonistic way. There is a real need for open dialogue to share the facts, backed by credible third-party certifiers, about ADs and digestate treatment systems. This could be mediated by state officials and independent non-profits to add credibility. In Washington, the interagency Clean Energy Siting Council recommends Community Benefit Agreements (CBAs), legal contracts defining what benefits a developer will provide to local governments or community groups in exchange for their support for a project. These can help mitigate local concerns and make the project more impactful by tailoring the benefits to the community's needs, such as through annual payments, support for public works, and so on. As noted previously, the path forward that may have the most promise in terms of community acquiescence is building ADs *and* installing digestate treatment systems.

Project-Level Barriers

8. Barrier: Farmer mistrust of developer promises or concern about getting overwhelmed

- **Potential Solution: Involve local partners like a nonprofit organization that works with farmers, another dairy, or a university extension office**

  Some farmers are skeptical of AD developer claims and worry they'd be left holding the bag if developers abandon the project. Others are concerned about being overwhelmed by a whole new set of challenges related to having an AD on their property or participating in a hub and spoke venture.

Farmers could use a credible ally so they're not on their own in negotiating with developers – and so they have realistic expectations of the challenges involved with ADs, as well as a means to share suggestions and seek assistance. Local partners are the most credible options, such as a nonprofit organization that works with farmers, another dairy, or a university extension office.

9. Barrier: Herd size too small for ADs to pencil out

- **Potential Solution: Where feasible, team up with other dairies in a centralized digester hub and spoke venture, or explore from a growing suite of emerging alternative manure management strategies/solutions; e.g. cover and flare, vermicomposting, and more.**
  Dairies with herd sizes that are too small to feasibly support an AD on their own could join with other nearby dairies in a centralized digester hub and spoke venture, sending their manure to a central digester. This would only work for dairies that are close enough to each other to make transporting manure (typically by truck) feasible. And the total number of milking cows participating still needs to be sufficient for the project to proceed at margins acceptable to the developers (according to developers we surveyed, the minimum threshold ranged from 1,500 to 20,000).

  Project specifics would vary on a case-by-case basis, including volumes of manure, cost-sharing, revenue-sharing, and so on. A project involving a dairy of 700 cows sending their manure to a close-by farm with 2,000 cows that built an AD onsite would look quite different than a project involving a cluster of 5+ dairies spread out over a larger region and a central AD built on a different property.

- **Potential Solution: Further facilitate the co-digestion of food waste with manure to expand biogas production and divert food waste from being disposed in landfills**

  Co-digesting food waste with manure can greatly expand biogas production. This is particularly the case for fats, oils, and grease, but it applies to other types of food waste as well at varying degrees. So even a relatively modest dairy can co-digest food waste and produce enough biogas in an AD for the economics to work out, provided the other factors (like proximity to the nearest gas pipeline and cost of an interconnection) are also within acceptable ranges.

  Washington has committed to a 2030 goal of 75% diversion of organic waste from landfills, and co-digestion of food scraps in dairy ADs would be a very effective tool in the toolkit – especially for material that can't be composted, like fats, oils, and grease. Preventing food waste from being landfilled and facilitating it being instead co-digested in ADs would also avoid a huge source of methane leaks from landfills. State policymakers could offer subsidies or tax credits to encourage co-digestion of food waste at ADs (including but not limited to dairy ADs) to achieve these important climate goals.

10. Barrier: Interconnection with nearest gas pipeline is prohibitively expensive and/or takes too long to be approved

- **Potential Solution: Incentivize/subsidize net-carbon-negative dairy RNG interconnection with the nearest gas pipeline**

  Some dairies in Washington may be very favorable candidates for building ADs to produce RNG except that interconnection with nearest gas pipeline turns out to be prohibitively expensive. Because RNG from dairy manure is net-carbon-negative, it would be beneficial to the state's pipeline network to facilitate such interconnections and displace fossil natural gas as much as possible.

Direct state subsidies for a dairy RNG interconnection are one option to do so. The amount of the subsidy could depend on the project's lifecycle carbon intensity, incentivizing projects with the greatest climate benefits.

- **Potential Solution: Streamline approval process for dairy RNG interconnections, including from state regulators and utilities**

  A pipeline interconnection might also take too long to be approved, dampening developer interest in pursuing the project at all or unnecessarily delaying progress (meaning the climate benefits from methane capture are also delayed). One developer noted that low competition and regulation of interconnections for RNG in Washington significantly increases capex, but that this could be avoided through better oversight. Policymakers could streamline the approval process for dairy RNG interconnections from state regulators, and institute guardrails against utilities vastly overcharging for interconnections.

11. Barrier: Difficulties in managing digestate

- **Potential Solution: Incentivize/subsidize the installation of nutrient recovery and water quality management infrastructure for digestate, and incentivize/facilitate its use to replace petroleum-derived fertilizers**

  Much of the focus on ADs revolves around biogas generation, since that is the projects' main revenue source. It is important to recognize that ADs by themselves do not also recover nutrients or treat water quality from the digestate. Issues relating to digestate are often less of a priority, even though digestate can be among the largest operational challenges to deal with. While untreated digestate can be land applied onsite at a farm, there may be too much of it and seasonal restrictions on land application mean that it would otherwise have to be trucked offsite for disposal.

  By installing digestate treatment systems, the digestate can be transformed from a burden to an asset while meeting strict water quality regulations. Advanced nutrient recovery and water quality management infrastructure for digestate have significant capex and opex. (There are multiple options depending on the technology and what nutrient end products are prioritized.) But they can produce high-value phosphorous-rich fertilizer and nitrogen-rich fertilizer that can displace the need for carbon-intensive synthetic fertilizers derived from petroleum. Depending on the specifics of the process, this fertilizer from digestate may command an additional price premium for being "natural" or "organic." This can be a sizable new revenue stream for a project while also eliminating the costs of trucking digestate offsite for disposal. This approach is actively being pursued by at least one of the dairy AD projects currently under development in the state.

  Given the major environmental benefits of nutrient recovery and water quality management infrastructure for digestate – especially less runoff into waterways/groundwater and lower greenhouse gases from fertilizer production – Washington could incentivize their installation through subsidies or tax credits. Expanding demand for higher cost, less carbon-intensive fertilizers made from digestate is a key priority, as there needs to be regional markets to offload them. State policy could also incentivize and facilitate the use of these fertilizers to replace petroleum-derived ones.

12. Barrier: Sand bedding significantly raises capex and opex

- **Potential Solution: Farmers switch to alternative bedding for the milking cows**

Sand bedding inevitably means sand getting into manure, which can severely damage AD performance, pumps, and nearly all manure pumping/piping systems. That's a deal breaker for some AD developers, but even if not, sand/grit removal systems would be required, significantly adding to capex and opex as well as logistical complexity. Farmers can avoid this by switching to alternative bedding for their milking cows.

That involves additional work and expense to clear out the sand and source different bedding materials, and it may not always be feasible or worth the hassle in the farmers' opinion. But if doing so unlocks the potential for AD deployment, then switching from sand bedding could be seen as a one-time investment that is well worth it.

13. Barrier: Flush collection doesn't work with the centralized digester hub and spoke model if using trucks to transport the manure

- **Potential Solution: Farmers switch to scrape collection**

  For dairies in a centralized digester hub and spoke AD venture, it is far too impractical and expensive to transport flush-collected manure in trucks to the central digester. (It's a different story for a single dairy with an onsite AD, which can certainly use flush collection of manure to transport it there; multiple such dairies could build their own ADs and participate in a centralized processing hub and spoke model where they all send their biogas to be upgraded at a single facility.) Dairies could instead switch to scrape collection of manure, which does not add water to the manure, meaning the trucks could transport more feedstock for the digester in every trip.

  Switching to scrape collection involves additional work and expense to change machinery and train employees on different procedures. This may not necessarily be feasible or worth the hassle, depending on a dairy's economics and on farmer preferences. But if doing so opens the door for participating in a hub and spoke AD venture, then switching from flush collection could be considered a favorable one-off investment.

14. Barrier: Dairy too small or far from gas pipeline for AD to be viable

- **Potential Solution: Incentivize cover-and-flare and other manure methane reduction measures, through subsidies and/or earning credits for methane destruction in voluntary market**

  The focus of this report is on how to facilitate the buildout of dairy ADs in Washington to achieve climate benefits. However, not all dairies are feasible candidates for ADs, because their herd sizes are too small, they are too far from gas pipelines to be viable producers of RNG, or biogas-to-electricity production is not viable for market or logistical reasons. These dairies can still adopt climate-friendly technological solutions, although they would typically need financial assistance.

  In terms of cutting methane emissions from manure, a less beneficial but still worthwhile alternative to ADs is to cover the manure and flare the resulting biogas. Flaring avoids the release of very potent methane into the atmosphere and instead produces much less potent carbon dioxide; since methane is 84 times stronger than CO2 over a 20-year period, this is a significant win for the climate.

  There are extremely efficient flares that can handle low and variable gas flows. These flares can be incentivized through state subsidies. They can also earn credits for methane destruction in the

voluntary market, although this is a novel pathway and much remains unclear about certification of the environmental attributes (including where they would count, what the longevity would be, ensuring that it is avoided methane from the baseline rather than added methane from herd expansion, etc.). State policymakers could provide clarity on these matters so that a more robust voluntary market for credits from flaring dairy methane could take hold in Washington.

There are also a few other non-AD dairy manure methane reduction strategies worth exploring. One is Windfall Bio's methane-eating microbes (mems), which convert methane into nitrogen-rich liquid biomass that can be processed into high-value organic fertilizer. Others are mixing in certain materials to manure lagoons to lower methane emissions. A study prepared for the California Air Resources Board in 2021 found that adding biochar, acids, and straw to manure could mitigate methane emissions by 82.4%, 78.1%, and 47.7%, respectively. Additional efforts are underway to mitigate "enteric fermentation" emissions; most notably, NRCS and the Dairy Federation are involved in a pilot project using *Bovaer*, a synthetic feed additive designed to reduce enteric emissions from dairy cows by inhibiting an enzyme that produces methane in their rumen.

ENERGY VISION

Energy Vision is a national 501(c)(3) environmental NGO whose mission is to advance sustainable solutions for a green economy through research, outreach and advisory. We focus on feasible solutions deployable today, with a major emphasis on near-term strategies to cut methane emissions and the opportunities to beneficially use this captured methane to decarbonize hard-to-abate sectors including heavy-duty transportation, agriculture, landfills, international shipping, and other heavy industries. We drive progress through reports, presentations, workshops and other convenings, close collaboration with relevant stakeholders, and direct engagements with government, industry, academia and other NGOs.

ENERGY VISION
New York | Seattle
(212) 228-0225
www.energy-vision.org