Renewable Natural Gas: An Assessment of Arizona's Resource Potential, Opportunities and Obstacles

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Executive Summary

Arizona possesses a significant renewable natural gas (RNG) resource base associated with landfills, dairy operations, wastewater treatment systems, food waste, woody biomass, and other organic resource streams. Interest in RNG has expanded as utilities, municipalities, agricultural producers, fleet operators, and private-sector organizations evaluate strategies that can reduce methane emissions, recover value from underutilized resources, diversify fuel options, and leverage portions of the existing natural gas and transportation infrastructure. The scale, economics, and environmental performance of RNG opportunities vary across resource types, project configurations, and market conditions.

RNG refers to pipeline-quality natural gas (nearly pure methane) produced by upgrading biogas generated from organic resource streams. In the United States, current commercial RNG production relies primarily on landfill gas, animal manure, food waste, and wastewater treatment systems. Additional pathways involving woody biomass and hydrogen (H_2)-related applications continue to evolve but typically require more complex conversion technologies, additional infrastructure, or stronger economic incentives.

Arizona's resource profile differs from its neighboring states in several important respects. Large landfill facilities and concentrated dairy operations create significant methane-recovery opportunities in some regions of the state, while transportation distances, interconnection and infrastructure requirements, water considerations, and access to premium fuel markets influence development conditions. Existing federal incentives and clean-fuel credit programs currently play a vital role in project economics, particularly for transportation applications.

This assessment evaluates the relative scale, technical maturity, and development considerations associated with major RNG resource categories in Arizona. Key findings include:

- Landfill gas and animal manure currently represent the largest and most commercially mature RNG resource categories in Arizona under existing market and policy conditions. Large landfill facilities and concentrated dairy operations provide the strongest near-term opportunities for methane capture and RNG production.
- Wastewater treatment facilities and food waste provide smaller but potentially important complementary resource opportunities, particularly where existing infrastructure, co-digestion capabilities, or local fleet applications align with project economics.
- Woody biomass and selected RNG-to-H_2 pathways may offer longer-term opportunities but currently face greater technical, infrastructure, and economic challenges than more established RNG pathways.
- RNG can reduce methane emissions from landfills, manure, wastewater systems, and other organic resource streams while producing a gaseous fuel compatible with the existing nat-

ural gas and transportation infrastructure. Environmental performance varies across pathways and depends on resource characteristics, methane-capture effectiveness, project design, lifecycle accounting assumptions, and end-use applications.

- Manure-based RNG pathways can achieve low or often net-negative lifecycle greenhouse gas emissions under certain accounting frameworks because methane avoidance contributes to emissions reductions. Landfill gas and wastewater pathways can also provide meaningful methane-reduction benefits relative to uncontrolled emissions scenarios.
- Well-designed anaerobic digestion (AD) systems that use animal manure and food waste to produce RNG can reduce overall freshwater demand relative to the baseline, enable reuse of treated liquid streams, and recover new water from the process.
- RNG projects can contribute to local economic activity through infrastructure investment, construction, operations, and resource-management services, although project economics vary significantly across resource types and market structures.
- Near-zero nitrogen oxides (NO_x) natural gas vehicle technologies fueled with RNG can reduce certain air pollutant emissions relative to older diesel technologies in selected fleet applications. Air-quality benefits depend on vehicle technology, fleet characteristics, duty cycles, and local air-quality conditions.
- Arizona currently does not have a Clean Fuel Standard, in contrast to California and several other western states. As a result, many Arizona RNG projects rely heavily on federal incentives and access to out-of-state clean-fuel credit markets to support project economics.
- National RNG supply has expanded rapidly in recent years, increasing competition for premium fuel markets and long-term off-take agreements. Future project viability will depend on evolving credit markets, infrastructure access, technology performance, financing conditions, and policy stability.

Overall, this assessment indicates that RNG can contribute to Arizona's broader energy, emissions-reduction, and resource-management landscape, particularly where methane capture, resource recovery, and fuel use intersect. The strongest near-term opportunities currently involve landfill gas and selected manure-based pathways with favorable infrastructure access and market conditions. Future deployment conditions will continue to evolve alongside technology development, market dynamics, infrastructure investment, and state and federal policy frameworks.

I. Introduction

Utilities, municipalities, fleet operators, agricultural producers, waste-management operators, and private-sector organizations in Arizona are evaluating strategies that can recover value from underutilized organic resources, diversify fuel options, reduce methane emissions, and leverage existing infrastructure systems. Landfills, wastewater treatment facilities, agricultural operations, and other organic resource streams can produce biogas that operators upgrade into renewable natural gas (RNG). Arizona's rapid population growth, expanding industrial activity, regional freight movement, water constraints, and evolving energy landscape shape how different resource utilization pathways may develop within the state.

Interest in RNG has expanded nationally as utilities, municipalities, fleet operators, agricultural producers, waste management operators, and the private sector evaluate options for reducing emissions associated with organic resource management and fuel use. RNG can reduce methane emissions from landfills, manure, wastewater systems, and other organic resource streams while producing a gaseous fuel compatible with the existing natural gas and transportation infrastructure. Resource availability, infrastructure access, project scale, financing structures, environmental performance, and policy incentives can vary across project types and locations, creating major differences in project feasibility and long-term economics.

Arizona presents a distinct context for RNG development. It differs from neighboring states in resource distribution, infrastructure configuration, agricultural geography, water availability, regulatory structure, and market incentives. Large landfill facilities and concentrated dairy operations create significant methane-recovery opportunities in some regions of the state, while transportation distances, water considerations, infrastructure interconnection requirements, and access to premium fuel markets influence development conditions. Existing federal incentives and clean-fuel credit programs currently play a vital role in project economics, particularly for transportation applications.

Arizona's broader energy and environmental priorities extend beyond methane management alone. State and local decision-makers continue to evaluate multiple pathways for reducing emissions, improving air quality, strengthening resource resilience, supporting economic development, and managing infrastructure costs. RNG can contribute to Arizona's broader landscape, particularly where methane capture, resource recovery, and fuel use intersect.

This white paper provides an Arizona-focused RNG Resource Assessment examining development considerations, infrastructure implications, and market dynamics relevant to the state. The analysis evaluates major in-state resource categories, including landfill gas, animal manure, wastewater treatment systems, food waste, woody biomass, and selected H_2-related pathways. The paper also evaluates environmental, economic, infrastructure, and market considerations associated with RNG production and use and examines the policy conditions that influence project feasibility and long-term development conditions. The goal is to support more informed discussion among policymakers, local governments, industry, utilities, community stakeholders, and other interested parties regarding the potential opportunities, constraints, and tradeoffs associated with RNG development in Arizona.

Key Terms and Definitions

Several terms used in renewable natural gas discussions carry different meanings across technical, regulatory, and policy contexts. The definitions below reflect commonly used terminology relevant to this assessment.

Renewable natural gas (RNG) is pipeline-quality methane-rich gas produced from biogas generated from organic resource streams. Whereas raw biogas (typically 45-65% methane content and 35-55% carbon dioxide (CO_2), plus moisture and other impurities[1]) could generate heat or power, mostly for on-site or local applications, RNG is completely interchangeable with conventional natural gas once processed or “upgraded.” RNG can have much lower lifecycle greenhouse gas emissions than fossil natural gas; actual carbon intensity (CI) varies by feedstock and project. When sourced from animal manure or some food waste pathways, RNG can be net carbon negative, meaning more carbon dioxide equivalents are avoided (as high global warming potential methane) during its production than emitted (as less global warming potential carbon dioxide) when it is combusted. Wastewater emissions, while not carbon-negative, are typically well below that of fossil natural gas, and landfill gas emissions can range anywhere from approximately half the CI of fossil natural gas to values that overlap with fossil natural gas at the high end.

Anaerobic digestion (AD) is a process where bacteria break down organic matter, such as animal manure and food wastes, in the absence of oxygen within a sealed vessel. This process yields two valuable outputs: biogas and digestate. Biogas can be a fuel to generate heat, electricity, or upgraded into RNG. Digestate, the remaining liquid and solid material, is a nutrient-rich co-product that can be a resource for fertilizer, animal bedding, or for bio-based products.

Co-digestion is the simultaneous AD of more than one organic material in the same digester (e.g., manure or wastewater solids with source-separated food waste or fats, oils, and grease). At water resource recovery facilities or farm digesters with excess capacity, adding energy-rich substrates can raise biogas yield and may stabilize operation; programs typically add receiving/pre-processing and feedstock-quality controls to manage contamination and variability[1].

[1] United States Environmental Protection Agency, “Region 9: Organics: Anaerobic Digestion, Co-Digestion,” United States Environmental Protection Agency, accessed August 27, 2025, https://archive.epa.gov/region9/organics/web/html/codigest.html.

II. Arizona RNG Feedstock Availability Assessment

Arizona's modeled RNG potential links directly to the volume and type of organic "waste" feedstocks generated in the state and the economic/technological viability to collect and process these feedstocks. To estimate that potential, a 2025 RNG supply assessment from the American Gas Foundation (AGF) estimates the RNG production potential of all 50 states in four different scenarios depending on levels of policy and market investment in RNG:

- **Low** (assumes AD utilization of ~30–60%; thermal gasification of ~5–30%, and 10% of the technical potential)
- **High** (assumes AD utilization of ~50–80%; thermal gasification of ~15–50%, and 23% of the technical potential)
- **Ambitious** (assumes AD utilization of ~70–95%; thermal gasification of ~25–70%, and 43% of the technical potential)
- **Technical** represents the theoretical maximum potential, regardless of cost[2].

Table 1 shows Arizona's RNG potential from AD in each of the four scenarios listed above, as well as the state's total RNG potential in each scenario from both AD and thermal gasification. According to the recent AGF study, Arizona has a total RNG potential of 23 trillion British thermal units per year (tBtu/yr) in the Low Scenario, 43.6 tBtu/yr in the High Scenario, 86.4 tBtu/yr in the Ambitious Scenario, and 143.7 tBtu/yr in the Technical Scenario.

Table 1: Total RNG Potential in Millions of British Thermal Units (MMBtu) annually

Scenario	Total RNG Potential (AD Only) (MMBtu/yr)	Total RNG Potential (MMBtu/yr)
Low	16,200,000	23,000,000
High	29,400,000	43,600,000
Ambitious	44,800,000	86,400,000
Technical	62,500,000	143,700,000

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[3].

Table 2 summarizes RNG production potential by feedstock across the Low, High, Ambitious, and Technical AGF scenarios, as well as the percentage that each feedstock could contribute to Arizona's total RNG production by scenario[4]. One column reflects the percentage total considering

[2] ICF, *Renewable Natural Gas Supply Assessment* (American Gas Foundation, 2025), 109, https://gasfoundation.org/wp-content/uploads/2025/07/AGF-RNG-Study_FINAL-09022025.pdf.
[3] ICF, *Renewable Natural Gas Supply Assessment*.
[4] ICF, *Renewable Natural Gas Supply Assessment*, 91, Appendix B.

AD only, and the other considers both thermal gasification and AD. Percentages reflect each feedstock's share of Arizona's total RNG production potential across all feedstocks in that scenario.

Table 2: Arizona's RNG Potential: Breakdown by MMBtu/yr and Percentage (%) of Total RNG Production Across AGF Scenarios [5]

Feedstock	Scenario	RNG Potential MMBtu/yr	% of Total RNG Production by Scenario (AD Only)	% of Total RNG Production by Scenario (AD + Thermal Gasification)
Manure	Low	2,200,000	13.6	9.6
	High	4,400,000	15.0	10.1
	Ambitious	7,600,000	17.0	8.8
	Technical	22,500,000	36.0	15.66
Food Waste	Low	0	0	0
	High	700,000	2.38	1.6
	Ambitious	2,400,000	5.36	2.78
	Technical	3,400,000	5.44	2.37
Landfill Gas	Low	13,500,000	83.3	58.7
	High	23,600,000	80.3	54.13
	Ambitious	33,500,000	74.8	38.77
	Technical	34,900,000	55.8	24.3
Wastewater Treatment Plants	Low	500,000	3.09	2.17

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[6]

Across all four AGF scenarios, Arizona's RNG potential concentrates on four feedstocks: landfill gas (LFG) and animal manure, which AD can process; and municipal solid waste (MSW) and energy crops, which thermal gasification can be process. The following are the definitions of all the feedstocks analyzed herein[7].

[5] Due to rounding values may not sum to exactly 100%.
[6] ICF, *Renewable Natural Gas Supply Assessment*.
[7] ICF, *Renewable Natural Gas Supply Assessment*, tbl. 1.

Feedstocks for AD:

- **Animal manure** is generated by livestock, including dairy cows, beef cattle, swine, and poultry.
- **Food waste** comes from commercial, industrial, and institutional sources such as processors, grocery stores, cafeterias, and restaurants.
- **Landfill gas (LFG)** is generated by the anaerobic decomposition of organic waste in landfills, producing a mix of gases, including up to 40–60% methane.
- **Wastewater** contains liquids and solids from household, commercial, and industrial use; the processing generates sludge that can serve as feedstock for RNG.

Feedstocks for Thermal gasification:

- **Agricultural residue** includes crop remains such as stalks, stems, leaves, branches, and seed pods left in fields, orchards, and vineyards after harvest.
- **Energy crops** are purpose-grown perennial grasses, trees, and annual crops (e.g., sorghum, energy cane, eucalyptus, miscanthus, pine, poplar, switchgrass, willow) that supply uniform feedstocks for energy production.
- **Forest residues** come from logging, forest and fire management, and milling, and include logging residues, thinnings, and mill residues, excluding specially designated forests such as wilderness or national parks.
- **Municipal solid waste** refers to the biogenic fraction of waste that remains after diversion of other products, including paper, paperboard, and yard trimmings.

In the Low and High cases, landfill gas (LFG) accounts for more than 50% of the state's total RNG production potential. Its share declines to 38.8% and 24.3% in the Ambitious and Technical cases, respectively, as higher utilization assumptions bring additional resources (namely, energy crops and municipal solid waste) into play. Actual scalability and costs are site-specific; for example, if a landfill already has gas collection and control systems (GCCS) in place, adding an LFG energy project—such as RNG-upgrading for pipeline injection or onsite power/thermal generation—can make it a better candidate for energy recovery. EPA treats an existing collection/flare as a sunk cost, so capital typically covers only the modifications needed for the energy project, meaning incremental capital is typically lower than at greenfield sites[8]. Animal manure also shows strong potential, particularly in Ambitious and Technical scenarios, reflecting the state's dense, centralized dairy operations that are conducive for AD. However, tapping into that potential is site-specific and will require significant capital, as many large dairies still lack digesters.

[8] United States Environmental Protection Agency, *Chapter 4: Project Economics and Financing*, LFG Energy Project Development Handbook (United States Environmental Protection Agency, 2021), https://www.epa.gov/system/files/documents/2021-07/pdh_chapter4.pdf.

This white paper focuses on AD pathways (LFG, animal manure, wastewater, food waste) as Arizona's most commercially established options today, while recognizing that thermal gasification feedstocks (agricultural residue, energy crops, forest residue, and MSW) contribute mainly to AGF's Ambitious and Technical scenarios and carry greater cost and technological uncertainty. Food waste and wastewater treatment AD pathways show limited contributions except under the most ambitious assumptions. Arizona lacks a statewide food waste diversion mandate[9] and has limited large-scale collection infrastructure, meaning food scraps will continue to decompose in landfills, absent new policies or programs. Several Arizona wastewater treatment facilities already produce RNG through AD and biogas upgrading systems, although broader deployment will likely depend on future incentives, market conditions, and policy support. LFG and animal manure represent Arizona's most commercially established RNG opportunities today. Other resource pathways contribute smaller shares of the state's overall RNG potential, while thermal gasification, of MSW and energy crops, becomes increasingly present in the Ambitious and Technical scenarios.

1. Animal Manure

The primary driver for Arizona's animal manure feedstock potential stems from the dairy industry. Arizona's dairy sector ranks 14th nationally[10] in milk production and is notable for having some of the largest average herd sizes in the nation, which supports the applicability of AD for manure management. According to the 2022 USDA Census of Agriculture data, Arizona has 122 total dairy farms, including 29 dairies with 2,500 or more milk cows, which account for about 92% of the state's ~200,000 total milk cows[11]. The state has several active AD systems, broken down by facility name, city, county, developer/operator, host site, feedstock, status (operational year), product and delivery.

[9] "Arizona Food Waste Policy," U.D. Food Waste Policy Finder, August 19, 2025, https://policyfinder.refed.org/arizona/.
[10] AgWest Farm Credit, *Dairy Industry Perspectives* (2025), https://www.agwestfc.com/docs/default-source/business-resources/industry-insights/industry-perspectives/2025_dairy_industry_perspective.pdf?sfvrsn=f6373917_11.
[11] United States Department of Agriculture National Agricultural Statistics Service, *Census of Agriculture - State Data* (United States Department of Agriculture, 2022), https://www.nass.usda.gov/Publications/AgCensus/2022/Full_Report/Volume_1,_Chapter_1_State_Level/Arizona/st04_1_017_019.pdf.

Table 3: Arizona RNG Sites Breakdown:
By Location, Product and Delivery, Production, Emission Reduction, and Livestock Number

Facility	City, County	Host Site	RNG Product & Delivery	Annual RNG Production (MMBtu/yr)[12]	Estimated CO_2 Displacement (Mt CO_2/yr)[13]	Number of Live-stock[14]
Butterfield RNG 1, LLC	Buckeye, Maricopa	Butterfield Dairy	Southwest Gas (SWG) pipeline	300,000 (≈3,000+ homes powered)	16,000 (≈3,500+ cars eliminated)	25K dairy cows[15]
Maricopa RNG 1, LLC "Milky Way"	Maricopa, Pinal County	Milky Way Dairy	SWG pipeline	375,000 (≈3,700+ homes powered)	20,000 (≈4,300+ cars eliminated)	35K dairy cows[16]
Caballero Dairy Farms Digester	Eloy, Pinal County	Caballero Dairy	El Paso Natural Gas Pipeline	73,400 (≈700+ homes powered)	4,000 (≈800+ cars eliminated)	8.8K dairy cows[17]
Green Gas Partners Stanfield	Stanfield, Pinal County	Regional dairies	Natural gas pipeline trans-ported to CA	757,000 (≈7,600+ homes powered)	40,000 (≈8,700+ cars eliminated)	55K dairy cows[18]
Align RNG – Snowflake	Snowflake, Navajo County	PFFJ/Smith field swine facility	Third-party pipeline system	138,600 (≈1,400+ homes powered)	7,000 (≈1,600+ cars eliminated)[19]	154K swine[20]

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[12] And equivalent in Arizona homes powered annually (at 12,900 kilowatt hours per home-year). See Appendix A. Tables 3 & 4 Reported RNG Emissions Reductions in Metric tons/year to Cars Eliminated From Road Calculations for a breakdown
[13] And equivalent in passenger vehicles eliminated from the roads annually. See Appendix A. for a breakdown.
[14] Livestock counts indicate project scale and potential feedstock availability, and while larger herds generally generate more manure, herd size does not directly determine RNG output. CO_2 displacement and car-equivalent estimates are calculated from reported RNG production; RNG output per animal varies by manure collection, project design, digester operation, methane capture, co-digestion, and reporting boundaries.
[15] Avolta, "Butterfield Project Overview," Avolta Development, https://avoltadevelopment.com/featuredprojectsbf/.
[16] Nacelle, "Milky Way Dairy Project," Nacelle Solutions, https://nacellesolutions.com/project/milky-way-dairy-project/.
[17] "Brightmark Breaks Ground on Caballero RNG Project in Arizona," Waste 360, May 4, 2021, https://www.waste360.com/gas-to-energy/brightmark-breaks-ground-on-caballero-renewable-natural-gas-project-in-arizona.
[18] Plamena Tisheva, "Suburban Propane Buys RNG Assets from Equilibrium," Renewables Now, January 3, 2023, https://renewablesnow.com/news/suburban-propane-buys-rng-assets-from-equilibrium-810236/.
[19] Align, "Align RNG – Projects," Align Renewable Natural Gas, accessed September 3, 2025, https://alignrng.com/projects.aspx.
[20] AgSTAR, "Livestock Anaerobic Digester Database," June 2024, https://www.epa.gov/sites/default/files/2020-10/agstar-livestock-ad-database.xlsx.

Sunoma Renewable Biofuel	Gila Bend, Maricopa County	Paloma Dairy	Delivered to CA Market through SWG pipeline[21]	180,000 (≈1,800+ homes powered)	9,500 (≈2,100+ cars eliminated)	14K+ dairy cows[22]

Table 4: Arizona Biogas-to-Electricity Projects:
By Location, Product and Delivery, Production, Emission Reduction, and Livestock Number[23]

Facility	City, County	Host Site	Product and Delivery	Electricity Production (kWh/yr)[24]	Reported CI (gCO_2e/MJ)[25]	Number of Livestock
Stotz Southern Dairy Digester	Buckeye, Maricopa	Stotz Dairy	Biogas electricity delivered to CA's electric grid for transportation using book-and-claim accounting	5,256,000 (≈400+ homes powered)	-762.09[26] (≈3,100+ cars eliminated)	15,000 dairy cows
Triple G Dairy Digester	Buckeye, Maricopa	Triple G Dairy	Cogeneration, connected with Arizona Public Service distribution feeder to convey electricity to CA EVs	4,467,600 (≈300+ homes powered)	-587.24[27] (≈2,100+ cars eliminated)	4,000 dairy cows

As indicated above (see Table 3 and Table 4 for a breakdown of each site), as of late-2025 Arizona has at least six pipeline-injected RNG facilities plus two biogas-to-electricity sites[28]. Pipeline-RNG sites include Butterfield Dairy (Buckeye), Milky Way Dairy (Maricopa), Caballero/Eloy RNG (Pinal), Sunoma/Paloma Dairy (Gila Bend), Align RNG (Snowflake; swine), and Green Gas

[21] California Air Resources Board, *Staff Summary: Sunoma Renewable Biofuel, LLC, Gila Bend, Arizona Compressed Natural Gas (CNG) from Dairy Manure*, Application No. B0472 (California Air Resources Board, 2023), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0473_summary.pdf.
[22] Montrose Environmental, *Case Study: Sunoma Renewable Biofuel Project* (Montrose Environmental, 2022), https://montrose-env.com/wp-content/uploads/2017/09/SUNOMA_CASE-STUDY_final-030922.pdf.
[23] See Appendix A. Tables 3 & 4 Reported RNG Emissions Reductions in Metric tons/year to Cars Eliminated From Road Calculations for breakdown
[24] And equivalent in Arizona homes powered annually (at 12,900 kilowatt hours per home-year). See Appendix A. Tables 3 & 4 for a breakdown
[25] And equivalent in passenger vehicles eliminated from the roads annually. See Appendix A. Tables 3 & 4 for a breakdown
[26] CleanFuture, Inc, *Staff Summary CleanFuture, Inc. Stotz Dairy Southern, Buckeye, AZ Electricity from Dairy Manure Biogas*, Tier 2 Pathway Application (CleanFuture, Inc, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0111_summary.pdf.
[27] CleanFuture, Inc, *Pathway Description for Electricity from Biogas for Electric Vehicle Charging in California* (CleanFuture, Inc, 2020), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0148_report.pdf.
[28] EPA's AgSTAR database is the canonical source for livestock projects, but the public interface does not show a static, citable Arizona count; it is updated periodically and projects move between planned/under construction/operating. The exact count of a State's operating RNG projects varies by source and whether biogas-to-electricity digesters are included.

Partners (Stanfield). In contrast to the other listed RNG digesters that process manure from cows from dairy farms, the Align RNG Snowflake Digester processes manure from over 154,000 hogs. Green Gas Partners' Stanfield site is currently the only Arizona RNG facility permitted for and reporting co-digestion of food waste and FOG (fats, oils, and greases) in addition to dairy manure.

Two other projects—Stotz Dairy and Triple G Dairy—are both in Buckeye and classified as biogas-electricity or cogeneration sites. Biogas from these digesters is combusted in on-site engine-generator sets to produce electricity and exported to the Arizona Public Service (APS) distribution system via a distribution-feeder interconnection[29].

As of this writing, Arizona's dairy farm RNG projects are mostly manure-only, however co-digestion deserves attention both for operational stability and because 2023 Renewable Fuel Standard (RFS) guidance changes its economics. To assess the circumstances under which additional Arizona projects would choose to accept food waste, this white paper summarizes co-digestion's process benefits and the RFS crediting rules that now govern mixed-feedstock gas.

Co-digestion increases methane yields and can improve process stability, meaning the digester runs smoothly without crashes: pH stays buffered, inhibitors like ammonia and sulfides do not build up, the microbes get a balanced diet, and gas output remains steady. Adding diverse feedstocks through co-digestion balances nutrients and dilutes problem compounds, which both improves stability and increases methane yield[30]. However, co-digestion also poses risks to fouling a digester's biology without proper management and oversight, especially when combining multiple heterogeneous feedstocks[31].

Under the RFS, when a digester co-processes organic materials, the biogas produced ("gas stream") is split for crediting: the manure/biosolids derived gas stream qualifies as a cellulosic biofuel (D3 RINs, with a ≥60% GHG fuel pathway reduction minimum), while the food-waste-derived portions qualify as advanced biofuel credits (D5 RINs, with a ≥50% GHG fuel pathway reduction minimum)[32]. Before 2023, adding food waste would force producers to forfeit all D3 credit value (priced at ~$3.40 in 2023) from the manure portion, and accept only the lower value D5 credit (priced at ~$0.85 in 2023)[33]. This credit penalty has historically made co-digestion less financially attractive, especially for projects relying on RIN markets. As a result, many developers have avoided mixed-feedstock systems despite the potential for operational benefits.

[29] CleanFuture, Inc, *Pathway Description for Electricity from Biogas for Electric Vehicle Charging in California*.
[30] Mariana Ferdeș et al., "Anaerobic Co-Digestion: A Way to Potentiate the Synergistic Effect of Multiple Substrates and Microbial Diversity," *Energies* 16, no. 5 (2023): 2116, https://doi.org/10.3390/en16052116.
[31] Rudolf Braun and Arthur Wellinger, *Potential of Co-Digestion* (International Energy Agency, n.d.), https://www.iea-biogas.net/files/daten-redaktion/download/publi-task37/Potential%20of%20Codigestion%20short%20Brosch221203.pdf.
[32] EcoEngineers, *An Introduction To The Renewable Fuel Standard & The RIN Credit Program* (EcoEngineers, n.d.), https://cleancities.energy.gov/files/u/news_events/document/document_url/84/2_-Session_0_-_RIN_101_-_FINAL.pdf.
[33] Lavinsky Corey, "Cellulosic Waiver Credits in the Spotlight as D3 RIN Prices Remain High," S&P Global, November 22, 2023, https://www.spglobal.com/commodity-insights/en/news-research/blog/crude-oil/112223-biofuels-renewable-fuel-standard-rins-cellulosic-waiver-gasoline-diesel.

A 2023 clarification from EPA regarding the RFS now allows producers to apportion D3 and D5 RINs in relation to each feedstock's contribution[34]. That proportional approach now enables plants to accept some food waste without forfeiting all D3 value from the manure portion; total credit revenue now scales with the feedstock mix rather than being all-or-nothing. This change aims to remove the financial disincentive that was a roadblock to the co-digestion of food waste. Public reporting on implementation outcomes remains limited.

EPA's AgSTAR *Market Opportunities* report (2018) ranks Arizona eighth among the ten states with the most energy generating potential from swine and dairy operations and selected 56 Arizona dairy farms with over 500 cows (out of 182 total dairy operations) as technically feasible candidates for AD[35]. Arizona's dairy farms could reduce 59,000 metric tons (Mt) of methane emissions, have a methane production potential of 3.84 billion cubic feet per year, and a derived energy-generation potential of 3.5 million MMBtu/yr. The American Gas Foundation (AGF) 2025 RNG supply assessment report "summarizes the maximum resource production potential for the Low, High, Ambitious Emissions Reduction Scenarios, as well as Technical potential," and lists livestock manure's RNG production potential across all scenarios, Table 5 reproduces these results[36].

Table 5: Arizona Animal Manure RNG Potential:
By MMBtu and Percentage Total in Given AGF Scenario

Scenario	RNG Potential (MMBtu/yr)	% of Total RNG Production by Scenario (AD Only)	% of Total RNG Production by Scenario (AD + Thermal Gasification)
Low	2,200,000	14	9.6
High	4,400,000	15	10.1
Ambitious	7,600,000	17	8.8
Technical	22,500,000	36	15.7

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[37].

These values indicate that livestock manure contributes meaningfully across modeled scenarios; its relative share increases in the "technical" scenario, where physical constraints alone define the upper limit of resource use. Estimated capital costs for new ADs vary depending on herd size[38]:

- 500–999 cows: ~$4M on average

[34] United States Environmental Protection Agency, *Renewable Fuel Standard (RFS) Program: Standards for 2023–2025 and Other Changes*, Rules and Regulations no. 132, Federal Register (United States Environmental Protection Agency, 2023), https://www.govinfo.gov/content/pkg/FR-2023-07-12/pdf/2023-13462.pdf.
[35] United States Environmental Protection Agency, *Market Opportunities for Biogas Recovery Systems at U.S. Livestock Facilities*, EPA-430-R-18-006 (United States Environmental Protection Agency, 2018), https://www.epa.gov/agstar/agstar-market-opportunities-report.
[36] ICF, *Renewable Natural Gas Supply Assessment*, app. B.
[37] ICF, *Renewable Natural Gas Supply Assessment*.
[38] Michael S. Lerner, *Meeting The Methane Challenge: How the U.S. Can Reach Its 2030 Goal* (Energy Vision, n.d.), https://energy-vision.org/wp-content/uploads/2024/06/EV-National-AD-Report-1.pdf.

- 1,000–2,499 cows: ~$10M on average
- 2,500–4,999 cows: ~$20M on average
- 5,000+ cows: ~$50M on average

Conservative estimates based on the 2022 USDA Agricultural Census data estimate the total capital cost to build out AD and RNG infrastructure across Arizona's dairy and swine sector is likely in the range of $1.2-$1.3B. This estimate accounts for herd sizes and the number of operations reported, while acknowledging that the census caps individual herd counts at 2,500 head, meaning actual costs could be higher with quicker payback time if the concentration of herd sizes is on the upper end. This estimate only reflects upfront capital expenses, not annual operating costs.

2. Landfill Gas

According to EPA's Landfill Methane Outreach Program (LMOP), Arizona has 40 municipal solid waste landfills[39]. Out of this total, 18 are considered "candidates", defined by LMOP as landfills that are currently accepting waste or have closed within the past five years, contain at least one million tons of waste in place, and have no operational, under-construction, or planned energy recovery projects (a landfill may also be designated as a candidate if there is demonstrated interest from the site). In addition to meeting LMOP's baseline criteria, these sites also reflect *Energy Vision's* recommendations in *Leading with Landfills*, in that they: (1) are open (so gas collection systems can be installed or extended in time to capture methane from decomposing food waste within one year of waste placement); and (2) report landfill gas (LFG) flow rates at or above ≈700 standard cubic feet per minute (scfm), or approximately one million standard cubic feet per day (mmscfd)[40].

Two landfills can be classified as having future potential, meaning they are open but do not yet meet the technical criteria for "candidate" status, or they already host an operational project with remaining potential for additional energy recovery. Only one landfill gas-to-energy project is considered operational, meaning the "project or expansion is online," and the other 22 remaining landfills are either low potential, shutdown, or with unknown project status. 16 landfills in the state have no gas collection system (two have an unknown status) and together hold over 48 million tons of waste[41], indicating potential methane generation subject to site-specific feasibility. Another 17 landfills flare their captured gas rather than using it for energy production; none have an operational, planned, or under-construction project.

Based on the LMOP criteria, four landfills among the 18 candidates emerge as Arizona's strongest near-term RNG prospects: City of Glendale Municipal, State Route 85, Butterfield Station, and

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[39] United States Environmental Protection Agency, "LMOP Landfill and Project Database," August 18, 2025, https://www.epa.gov/lmop/lmop-landfill-and-project-database.
[40] Michael S. Lerner, *Leading With Landfills* (Energy Vision, 2025), https://energy-vision.org/wp-content/uploads/2025/07/EnergyVision-LeadingWithLandfills.pdf.
[41] This number excludes two landfills that did not report their waste in place values and one that had unknown values.

Los Reales. See Table 6 for a breakdown of the four most viable candidate landfills for near-term RNG potential.

Table 6: Arizona's Most Viable Landfills for Near-Term RNG Potential

Landfill Name	County	Ownership Type	Landfill Owner	Waste in Place (tons)	LFG Collected (mmscfd)	LFG Flared (mmscfd)
City of Glendale Municipal Landfill	Maricopa	Public	City of Glendale	12,305,865	1.697	1.697
State Route 85 Landfill	Maricopa	Public	City of Phoenix	15,687,676	1.455	1.455
Butterfield Station Landfill	Maricopa	Private	Waste Management of Arizona	44,000,640	1.261	1.261
Los Reales Landfill	Pima	Public	City of Tucson	24,816,670	1.023	1.023

Source: United States Environmental Protection Agency: Landfill and Landfill Gas Energy LMOP Landfill and Project Database[42]

Of these four selected sites, only Los Reales identifies a *proposed* RNG end-use in the transportation sector (the City of Tucson's compressed natural gas (CNG) fleet and other transportation customers) and contemplates interstate pipeline delivery[43]. However, interconnection to an interstate transmission system may not be available for Los Reales, with Southwest Gas Corporation's (SWG) system as the only plausible interconnection pathway, subject to standard technical review and compliance with SWG pipeline-quality requirements[44]. Although RNG development typically requires a gas collection system, sites without one may still warrant consideration, particularly when they contain large waste volumes and have not previously hosted energy-recovery projects. Table 7 displays landfill RNG production potential across all scenarios, reproduced below from AGF 2025 with the addition of percentages.

[42] United States Environmental Protection Agency, "LMOP Landfill and Project Database."
[43] City of Tucson (Environmental & General Services Department), *Landfill Gas Utilization Project: Request for Qualifications (RFQ)*, Request for Qualifications Project ID 230007 (City of Tucson (Environmental & General Services Department), 2022), https://procurement.opengov.com/portal/tucson-az/projects/23473/document?section=all&.
[44] Southwest Gas Corporation, "Comment by a Southwest Gas Representative on Shared Word Document Regarding Los Reales RNG Pipeline Acceptance," personal communication, February 4, 2026.

Table 7: Arizona Landfill Gas RNG Potential:
By MMBtu and Percentage Total in Given AGF Scenario

Scenario	RNG Potential (MMBtu/yr)	% of Total RNG Production by Scenario (AD Only)	% of Total RNG Production by Scenario (AD + Thermal Gasification)
Low	13,500,000	83.3	58.7
High	26,600,000	80.3	54.1
Ambitious	33,500,000	74.8	38.8
Technical	34,900,000	55.8	24.3

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[45].

Under the AGF 2025 assessment for Arizona, landfill gas is the largest single feedstock in the Low and High scenarios; it also makes up a significant portion of Arizona's total in the Ambitious and Technical scenarios. Targeted investment in high waste, open landfills without current energy projects would expand Arizona's RNG output while reducing methane emissions.

A current example of a potential Arizona LFG-to-RNG configuration appears in the Salt River Pima-Maricopa Indian Community's (SRPMIC) Priority Climate Action Plan. The plan describes a proposed landfill-gas-to-RNG project that would (1) use LFG already collected and flared at three community landfills, (2) route gas from the Salt River Landfill to a centralized RNG upgrading plant likely located at the Tri-Cities Landfill, and (3) deliver the upgraded RNG to the City of Mesa's natural gas distribution system via a new pipeline of roughly three miles[46].

Providing an estimate of the total cost associated with the build-out of LFG to RNG in Arizona would require site-specific data that is currently not publicly available. Specific LFG flow rates, existing pipeline infrastructure, and proximity to pipelines are factors that dramatically influence the project costs. EPA benchmarks suggest typical capital costs ranging from $6,200—$8,300 per scfm of gas flow; actual costs vary with specifications and scale[47]. For reference, RNG made from landfill biogas qualifies for cellulosic biofuel credits (D3 RIN) under the EPA's Renewable Fuel Standard[48].

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[45] ICF, *Renewable Natural Gas Supply Assessment*.
[46] *US EPA Climate Pollution Reduction Grant Program (CPRG) Priority Climate Action Plan: Salt River Pima-Maricopa Indian Community* (U.S. Environmental Protection Agency, 2025), https://www.epa.gov/inflation-reduction-act/salt-river-pima-maricopa-indian-community.
[47] United States Environmental Protection Agency, "Switch to Renewable Natural Gas," March 5, 2025, https://www.epa.gov/lmop/switch-renewable-natural-gas.
[48] United States Environmental Protection Agency, "Information about Renewable Fuel Standard for Landfill Gas Energy Projects," United States Environmental Protection Agency, April 24, 2025, https://www.epa.gov/lmop/information-about-renewable-fuel-standard-landfill-gas-energy-projects.

Separate from categorizing candidate sites in Arizona is growing recognition that various opportunities exist to optimize and enhance landfill operations. *Energy Vision* identifies three near-term measures to cut landfill methane: (1) deploy real-time monitoring and automated tuning to improve existing gas-collection systems; (2) start collection earlier in active areas by extending systems within about one year of waste placement; and (3) build new gas-collection systems at high-emitting landfills that lack them, prioritizing sites with gas flows ≥700 scfm as economically attractive and treating 250–700 scfm as a stretch tier[49].

Flaring of collected landfill gas reduces methane emissions when compared to uncontrolled release, as combustion converts methane to CO_2, but it does not recover the gas's energy content[50]. Where feasible, using LFG for energy (e.g. RNG upgrading or electricity/thermal) can achieve emission reductions while producing useful energy; when energy recovery is not feasible, EPA notes that continuing to operate a gas-collection system and flare generally provides the greatest methane reductions, and that vent flares can periodically destroy methane and mitigate some GHG emissions[51].

3. Wastewater Treatment Plants

Arizona is home to a few notable wastewater RNG projects, including the 91st Avenue Wastewater Treatment Plant (WWTP) in Phoenix, one of the largest wastewater-to-RNG facilities in the country, which serves 2.6 million residents of Mesa, Tempe, Scottsdale, Glendale, and Phoenix. Operated by the City of Phoenix as majority owner, the plant has wastewater treatment capacity of up to 230 million gallons per day (GPD)[52] as well as the capacity to produce raw biogas at a rate of 3,250 scfm. The biogas gets upgraded to RNG and delivered through a dedicated three-mile pipeline to an interstate natural gas pipeline connection. The RNG is then "sold on the open market as vehicle fuel under EPA's RFS program,"[53] as well as sold directly to vehicle fleets via an offtake contract.

Arizona is also home to the Tres Rios Water Reclamation Facility, located in Tucson, which by 2021 began delivering 550–600 scfm (about 440 MMBtu per day) of RNG into the Southwest Gas pipeline, with nearly 100,000 MMBtu purchased to date. The facility recovers up to 99.5% of methane from wastewater treatment, avoiding flaring and reducing emissions—an impact comparable to removing 2,500 vehicles from the road or supplying energy to 5,500 homes. Operating continuously, Tres Rios treats about 50 million GPD of wastewater and serves as the centralized

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[49] Lerner, *Leading With Landfills*.
[50] United States Environmental Protection Agency, "Continue to Operate Gas Collection System and Flare," June 25, 2025, https://www.epa.gov/lmop/continue-operate-gas-collection-system-and-flare.
[51] United States Environmental Protection Agency, "Convert Active System to Passive System with Vent Flares," United States Environmental Protection Agency, March 5, 2025, https://www.epa.gov/lmop/convert-active-system-passive-system-vent-flares.
[52] Heidi Hommel, "Wastewater Treatment Plant Reduces Valley Water Waste," Arizona Water Watch News, *KTAR.Com*, September 3, 2025, https://ktar.com/arizona-water-news/wastewater-treatment-plant/5745334/.
[53] Ameresco, "The 91st Avenue Wastewater Treatment Plant Is Now Capable of Processing Raw Bio Gas at a Rate of 3,250 Scfm," Ameresco, accessed August 28, 2025, https://www.ameresco.com/portfolio-item/city-of-phoenix-91st-avenue-wastewater-treatment-plant-az/.

biosolids treatment site for Pima County's eight water reclamation facilities[54]. Most recently, the City of Mesa began producing RNG at its wastewater treatment plant in 2025 for use in its existing fleet of natural gas-powered refuse trucks; Mesa has future plans to begin co-digestion as well.[55]

Together, the 91st Avenue, Tres Rios, and Mesa projects show that Arizona's largest metropolitan areas are already producing RNG from wastewater. Even so, this feedstock remains a relatively small contributor to the state's overall RNG potential. While Arizona has 133 publicly owned wastewater treatment facilities as of 2022, serving 5.5M people[56], the number of viable opportunities for large-scale RNG production has limitations and concentrates at the biggest plants. This limitation is because even though WWTP with capacities above five million gallons per day (MGD) that use AD—and currently flare biogas or burn it in boilers—may be suitable for RNG production if located within about five (ideally one) miles of a natural gas pipeline; facilities treating 50+ MGD generally achieve greater economies of scale. This economic reality makes the threshold for cost-effective RNG projects high[57]. Table 8 shows how much wastewater potential accounts for according to the 2025 AGF RNG supply assessment.

Table 8: Arizona's Wastewater Treatment Plants RNG Potential: By MMBtu and Percentage Total in Given AGF Scenario

Scenario	RNG Potential (MMBtu/yr)	% of Total RNG Production by Scenario (AD Only)	% of Total RNG Production by Scenario (AD + Thermal Gasification)
Low	500K	3.1	2.2
High	700K	2.2	1.6
Ambitious	1,300K	2.9	1.5
Technical	1,700K	2.7	1.2

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[58]

Across scenarios, WWTPs represent a modest share of Arizona's RNG resource potential. The main constraint is plant size: of Arizona's 133 publicly owned WWTPs, at least 107 treat less than 5 MGD, six treat between 5–10 MGD, 19 treat between 10–100 MGD, and only one facility treats 100–1,200 MGD. Co-digestion with food waste can raise yields, but the small number of mid- and

[54] Sean Corbett, "Tres Rios Renewable Gas Center Celebrates One Year Anniversary and Contributions to Reaching Pima County Emissions Goals," Southwest Gas Corporation, October 24, 2022, https://www.swgas.com/en/news/tres-rios-renewable-gas-center-celebrates-one-year-anniversary.
[55] Valley of the Sun Clean Cities Coalition, September 2025 Newsletter. https://www.cleanairaz.net/newsletters/september-2025
[56] United States Environmental Protection Agency, "Clean Watersheds Needs Survey Wastewater Dashboard," United States Environmental Protection Agency, 2022, https://sdwis.epa.gov/ords/sfdw_pub/r/sfdw/cwns_pub/wastewater-dashboard?
[57] Michael S. Lerner, *Can Your WasteWater Plant Do More?* (Energy Vision, n.d.), https://energy-vision.org/wp-content/uploads/2024/10/EnergyVision-WastewaterPrimer.pdf.
[58] ICF, *Renewable Natural Gas Supply Assessment*.

large-capacity plants limit statewide volumes, so wastewater remains a complementary feedstock relative to landfill gas and manure. By 2042, EPA projects 139 publicly owned WWTPs: 13 in the 5–10 MGD range, 25 in the 10–100 MGD range, and still just one in the 100–1,200 MGD range. This observation indicates that the size distribution and the constraint it creates largely persists.

4. Food Waste

Farms, residences, foodservice, retail, and manufacturing in Arizona generated almost 2M Mt of food waste in 2023, about 5% more than in 2016. Almost $9B and 346B gallons of water ends up in waste streams and almost 63K Mt of methane emissions results from food waste across all sectors, with the average person wasting $759 in uneaten food annually[59]. 730K tons (37.5%) decomposes in landfills and currently only 15.8K tons (.81%) gets used for AD[60]. The City of Mesa reports it is working toward a Food Waste to Energy program to produce RNG to fuel its solid "to fuel Mesa's solid waste fleet"[61], with city/partner leadership indicating Phase 1 ('Flare to Fuel') was underway by September 2025, with a later Phase 2 planned to incorporate food-waste preprocessing[62].

While food waste is an energy-dense feedstock, with published evaluations indicating biogas yields around 2.2–3.5 (MMBtu per metric ton)[63], actual project yields vary. Table 9 displays estimates for Arizona's food waste RNG potential according to AGF (2025).

Table 9: Arizona's Food Waste RNG Potential:
By MMBtu/yr and Percentage Total in Given AGF Scenario

Scenario	RNG Potential (MMBtu/yr)	% of Total RNG Production by Scenario (AD Only)	% of Total RNG Production by Scenario (AD + Thermal Gasification)
Low	0	0	0
High	700,000	2.4	1.6
Ambitious	2,400,000	5.3	2.8
Technical	3,400,000	5.4	2.4

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[64]

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[59] Jessica Boehm and Simran Parwani, "Chart Du Jour: Our Wasted Food," Axios, January 11, 2024, https://www.axios.com/local/phoenix/2024/01/11/chart-du-jour-our-wasted-food.
[60] ReFED, "ReFED - Food Waste Monitor," Insights Engine ReFED, accessed September 24, 2025, https://insights-engine.refed.org/food-waste-monitor?break_by=destination&indicator=tons-surplus&state=AZ&view=detail&year=2023.
[61] "Food Waste to Energy Initiative," Mesa AZ, https://www.mesaaz.gov/Government/City-Projects/Food-Waste-to-Energy.
[62] Energy Vision. "Personal Communication on City of Mesa Food Waste to Energy Program." Received by Matthew Tomich, 9 Jan. 2026.
[63] Patrick Ahlm et al., *Anaerobic Digestion Evaluation Study* (Great Plains Institute, 2018), https://recyclingandenergy.org/wp-content/uploads/2021/01/2018-09-GPI-Anaerobic-Digestion-White-Paper-Final-Report-1.pdf.
[64] ICF, *Renewable Natural Gas Supply Assessment*.

These numbers suggest that across scenarios, food waste is a relatively minor share relative to Arizona's other feedstocks. Current infrastructure remains sparse. Notable initiatives include the Stanfield RNG Facility, which imports various feedstocks (the majority being dairy manure) and co-digests more than 50K GPD of food waste[65], as well as the City of Mesa's Food-to-Energy pilot. However, the state lacks a food waste diversion mandate or large-scale organics' recycling infrastructure, which severely limits broader deployment. Until policy, infrastructure, and collection logistics catch up, food waste will remain a technically promising but underutilized resource in Arizona's RNG portfolio.

5. Woody Biomass

Arizona has substantial woody biomass potential—especially from forest restoration and hazardous-fuels reduction treatments (e.g., thinning in ponderosa pine and mixed-conifer forests) that generate large volumes of low-value small-diameter material and residues that can be converted to energy or fuels, while also supporting wildfire-risk reduction objectives[66].

For example, a Northern Arizona University feasibility review estimated ~133,405 bone-dry tons per year of realistically available biomass within a 50-mile radius of Flagstaff, with ~86% sourced from forest products manufacturing), indicating meaningful localized feedstock supply for bioenergy systems[67].

However, unlike other organic resource streams that AD can process, woody biomass requires thermal gasification and methanation. The AGF characterizes thermal gasification–to-RNG as "at an early stage of commercialization,"[68] with gasification/purification steps presenting challenges. As reflected in the AGF scenarios (see Table 10 below) Arizona's modeled contribution from forest residues is relatively small (500–1,400 billion Btu/yr) in Low/High scenarios and increases (2,400K–3,400K) in Ambitious/Technical scenarios. Current uses of woody biomass in Arizona include mulch, dimensional lumber, animal bedding, or bioelectricity[69]. Among RNG pathways, woody biomass-to-RNG remains technically complex and capital-intensive; limiting project deployment to date.

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[65] "Suburban RNG - Stanfield," Suburban Propane, accessed August 28, 2025, https://www.suburbanpropane.com/renewables/suburban-renewables/rng/suburban-rng-stanfield/.
[66] Nicholls, David, USDA, "Forest Products Cluster Development in Central Arizona—Implications for Landscape-Scale Forest Restoration," August 2014. https://www.fs.usda.gov/pnw/pubs/pnw_gtr898.pdf
[67] "Feasibility Review for a Wood Waste to Energy Conversion Facility on the Northern Arizona University Campus." Prepared by TSS Consultants for Northern Arizona University, April 2014. https://in.nau.edu/wp-content/uploads/sites/136/2018/08/Biomass-Feasibility-Final-Report-ek.pdf
[68] ICF, *Renewable Natural Gas Supply Assessment*, 8.
[69] Evan Hjerpe and Anne Mottek Lucas, *Regional Economic Contributions of the Four Forests Restoration Initiative (4FRI) in Northern Arizona in 2023* (The Nature Conservancy, n.d.), https://www.conservation-econ.org/_files/ugd/5fc209_016fb24ff8cd48c5bb20fda1a5568822.pdf?index=true&.

Table 10: Arizona's Woody Biomass RNG Potential: By MMBtu and Percentage Total in Given AGF Scenario

Scenario	RNG Potential (MMBtu/yr)	% Total RNG Production by Scenario (Thermal Gasification Only)	% Total RNG Production by Scenario (AD + Thermal Gasification)
Low	500,000	7.3	2.2
High	1,400,000	9.8	3.2
Ambitious	2,400,000	5.8	2.8
Technical	3,400,000	4.2	2.4

Source: American Gas Foundation's Renewable Natural Gas Supply Assessment, July 2025[70]

Nonetheless, there are complementary efforts underway in Arizona that could make woody biomass a viable feedstock in the future. For example, the Four Forest Restoration Initiative (4FRI) is a long-term U.S. Forest Service program to restore ecological resilience across 2.4M acres in northern Arizona using thinning and prescribed fire. From 2010 to 2024, 4FRI treated over 1,275,000 hazardous-fuel acres, and in FY2024 the initiative accomplished 200,000 hazardous fuel acres[71], completed 16,184 acres of commercial thinning, along with 88,810 acres of broadcast burning, 18,111 acres of non-commercial thinning, and 11,619 acres of pile burning, to reduce severe-wildfire risk and improve habitats and watersheds[72]. Coconino County's Biofuel Development Opportunity (BDO) identifies an estimated ~100,000 moisture-free "bone dry tons" (BDT)/yr of woody biomass available within a 75-mile drive distance from Bellemont (BDO Zone's defined boundary for assessing feedstock supply and delivered cost), comprising ~50,000 BDT/yr of forest residue, ~10,000 BDT/yr of sawmill residuals, and ~40,000 BDT/yr of woodland biomass[73]. By comparison, California's state–federal Wildfire & Forest Resilience initiative sets a goal to treat a minimum of 1M acres annually by 2025[74].

6. Low Carbon-Intensity Hydrogen

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70 ICF, *Renewable Natural Gas Supply Assessment*.
71 Forest Service, "Four Forest Restoration Initiative - Implementation," Forest Service United States Department of Agriculture, September 9, 2025, https://www.fs.usda.gov/r03/natural-resources/forest-management/four-forest-restoration-initiative-implementation.
72 United States Department of Agriculture Forest Service, *Four Forest Restoration Initiative December 2024 Monthly Report* (United States Department of Agriculture Forest Service, 2025), tbl. 1, https://www.fs.usda.gov/sites/nfs/files/r03/publication/4fri-2024-december-monthly-report.pdf.
73 *Bioeconomy Development Opportunity Zone Rating | BDO Zone Designation: Coconino County* (Bioeconomy Development Opportunity Initiative, 2024), https://bdozone.org/wp-content/uploads/Coconino-AZ-BDO-Zone-Rating-FINAL.pdf?
74 California Wildfire & Forest Resilience, *Roadmap to a Million Acres* (n.d.), https://wildfiretaskforce.org/wp-content/uploads/2022/04/roadmap-to-million-acres_2022.pdf.

The Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA) establish federal incentives for low carbon-intensity (CI) H_2 production, end-use deployment, and supporting infrastructure[75,76]. The U.S. National Clean Hydrogen Strategy and Roadmap outlines targets “strategic, high-impact uses” in “the industrial sector, heavy-duty transportation, and long-duration energy storage to enable a clean grid,” and anchors federal climate goals including “net zero emissions no later than 2050”[77]. Within this framework, the §45V production tax credit (PTC) in the IRA provides a performance-based incentive for low-CI H_2. Under the final §45V rules, methane from “biogas … RNG derived from biogas, or fugitive sources of methane” can serve as feedstock for low-CI H_2, with lifecycle emissions determined under the 45VH2-GREET Model[78].

The rules define RNG and coal-mine methane. They allow taxpayers to treat a facility’s use of “RNG … or coal mine methane as being from a specific source … only if the taxpayer acquires and retires qualifying gas EACs [Energy Attribute Certificates],” subject to temporal and deliverability conditions[79]. The credit pays up to $3/kg (not adjusted for inflation) for the lowest CI tier for projects able to meet the stringent requirements. Separately, Public Law No. 119-21 (2025) amended Internal Revenue Code §45V(c)(3)(C) to require construction begin before January 1, 2028 (formerly 2033); the 10-year credit period still starts on the facility’s placed-in-service date. Projects that begin construction by the cutoff may still pencil out, including RNG-to-H_2 with carbon dioxide capture, but the eligibility window is now five years shorter[80]. Due to policy and market uncertainty and the short, imposed timeline for projects to start construction, biogas/RNG to H_2 opportunities in Arizona are likely to remain challenging and limited in the near term.

III. Environmental and Economic Benefits of Renewable Natural Gas

1. Environmental Benefits of RNG

Lower Lifecycle GHG Emissions:

RNG, produced by upgrading biogas from organic resource streams such as landfills, food scraps, wastewater, and manure, has lower lifecycle greenhouse gas (GHG) emissions than fossil natural

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[75] Department of Energy, “DOE Establishes Bipartisan Infrastructure Law’s $9.5 Billion Clean Hydrogen Initiatives,” Energy.Gov, February 15, 2022, https://web.archive.org/web/20250120082521/https://www.energy.gov/articles/doe-establishes-bipartisan-infrastructure-laws-95-billion-clean-hydrogen-initiatives.
[76] Office of Energy Efficiency & Renewable Energy, “Financial Incentives for Hydrogen and Fuel Cell Projects,” Energy.Gov, accessed March 25, 2024, https://www.energy.gov/eere/fuelcells/financial-incentives-hydrogen-and-fuel-cell-projects.
[77] *U.S. National Clean Hydrogen Strategy and Roadmap*, Strategy and Roadmap (U.S. Department of Energy, 2023), 29, 2, 6, https://www.hydrogen.energy.gov/docs/hydrogenprogramlibraries/pdfs/us-national-clean-hydrogen-strategy-roadmap.pdf.
[78] “26 CFR 1.45V-4 -- Procedures for Determining Lifecycle Greenhouse Gas Emissions Rates for Qualified Clean Hydrogen.,” eCFR, September 26, 2025, https://www.ecfr.gov/current/title-26/part-1/section-1.45V-4.
[79] 26 CFR 1.45V-4 -- Procedures for Determining Lifecycle Greenhouse Gas Emissions Rates for Qualified Clean Hydrogen., 26 CFR § 1.45V-4 (2025), https://www.ecfr.gov/current/title-26/part-1/section-1.45V-4.
[80] *See* Pub. L. No. 119-21, §70511 (2025) (amending I.R.C. §45V(c)(3)(C) to “before Jan. 1, 2028”); *see also* DOE, Clean Hydrogen Production Tax Credit Resources (max $3/kg with PWA; tiered by CI)

gas, depending on feedstock and accounting assumptions[81]. A GHG's climate impact depends on how long it remains in the atmosphere and how strongly it absorbs radiation. The global warming potential (GWP) embodies these characteristics; it converts emissions into CO_2e (carbon dioxide equivalents) values for comparison[82].

Over a 100-year horizon, one metric ton of methane has an estimated warming impact of about 27.9 Mt of CO_2e. Over 20 years it is about 81.2 Mt of CO_2e, highlighting the outsized near-term benefits of methane avoidance[83]. Capturing methane that would otherwise escape and using it as RNG both prevents those emissions and displaces fossil natural gas, which releases additional carbon from underground reserves.

Overall, RNG can deliver two types of climate benefit: (1) it avoids methane from organic resource streams when projects capture and destroy/flare the gas[84], and (2) it displaces fossil natural gas and its upstream extraction and leakage emissions. The magnitude varies by feedstock[85], and baseline practice (e.g., venting vs. flaring), and by gas-collection and destruction efficiency[86].

Lifecycle studies show wide variation in climate performance depending on the feedstock and baseline waste-management practice[87]. RNG produced from landfill gas, food waste or wastewater typically reduces GHG emissions by ~36 to 114% compared to fossil compressed natural gas (CNG). RNG from livestock manure can achieve highly net-negative emissions, with reported lifecycle carbon intensities ranging from –533 to –151 grams CO_2 equivalent per megajoule (gCO_2e/MJ)[88]. Dairy-manure RNG delivers a 2.9x to ~7.7x emissions benefit per unit energy relative to CNG[89]. By contrast, landfill gas RNG (where the baseline assumes flaring) offers smaller reductions, averaging ~51 gCO_2e/MJ, ~36% lower than fossil CNG. Net-negative values arise for dairy because projects capture and combust methane that would otherwise escape, with the avoided methane emissions outweighing the CO_2 released at combustion. For landfills, the

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81 United States Environmental Protection Agency, "Renewable Natural Gas," Overviews and Factsheets, United States Environmental Protection Agency, January 29, 2025, https://www.epa.gov/lmop/renewable-natural-gas.

82 United States Environmental Protection Agency, "Understanding Global Warming Potentials," Overviews and Factsheets, United States Environmental Protection Agency, January 16, 2025, https://www.epa.gov/ghgemissions/understanding-global-warming-potentials.

83 Intergovernmental Panel On Climate Change (Ipcc), *Climate Change 2021 – The Physical Science Basis: Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change--Chapter 7: The Earth's Energy Budget, Climate Feedbacks, and Climate Sensitivity*, 1st ed. (Cambridge University Press, 2023), sec. 7.6.1.1, table 7.15, https://doi.org/10.1017/9781009157896.

84 United States Environmental Protection Agency, "Benefits of Landfill Gas Energy Projects," Overviews and Factsheets, United States Environmental Protection Agency, April 18, 2025, https://www.epa.gov/lmop/benefits-landfill-gas-energy-projects.

85 Tom Cyrs et al., *Renewable Natural Gas as a Climate Strategy; Guidance for State Policymakers* (World Resources Institute, 2020).

86 United States Environmental Protection Agency, "Continue to Operate Gas Collection System and Flare."

87 California Air Resources Board, "Apply for an LCFS Fuel Pathway," accessed October 6, 2025, https://ww2.arb.ca.gov/resources/documents/apply-lcfs-fuel-pathway.

88 Jane O'Malley et al., *2030 California Renewable Natural Gas Outlook: Resource Assessment, Market Opportunities, and Environmental Performance*, White Paper (The International Council of Clean Transportation, 2023), https://theicct.org/wp-content/uploads/2023/05/california-rng-outlook-2030-may23.pdf.

89 Range based on certified LCFS carbon intensities of −151 to −533 gCO_2e/MJ vs. a 79.21 gCO_2e/MJ fossil baseline).

model assumes the methane would be combusted, so capturing and using it avoids less CO_2e resulting in a smaller CI reduction. See Table 11 for a detailed breakdown of the LCFS carbon intensities for various RNG pathways.

Table 11: LCFS Carbon Intensities for RNG pathways: By feedstock, CI, CNG Comparison, and Baseline assumptions

Feedstock pathway	**Representative CI (gCO_2e/MJ)**[90]	**% Reduction in GHG vs. Fossil CNG (79.21 gCO_2e/MJ)**[91]	**Baseline Assumption in LCFS Accounting**[92]
Livestock manure (dairy)	−151 to −533 (range of certified pathways)	>291%–77% reduction (net-negative)	LCFS credits avoided methane that would otherwise emit at the source
Source-separated organics (food waste)	−11 (average of certified pathways)	~114% reduction	Baseline varies by certified pathway; only some organics pathways receive avoided-methane crediting
Wastewater sludge	40 (average of certified pathways)	~50% reduction	LCFS does not apply avoided-methane credit to these pathways
Landfill gas	51 (average of certified pathways)	~36% reduction	LCFS does not credit avoided venting under current landfill-gas assumptions
Fossil CNG (comparison)[93]	79.21	—	CARB lookup table value for pipeline gas.

Source: 2030 CARB Outlook: Resource Assessment, Market Opportunities, and Environmental Performance[94]

Turning Unutilized Resource Streams from a Burden to an Asset

Capturing methane from organic resource streams (via AD at farms, wastewater treatment plants, or landfill gas collection) can convert the stream into usable energy. When further upgraded, the

[90] The International Council of Clean Transportation (ICCT) reports the values as averages of certified LCFS pathways by feedstock; they are not energy weighted.
[91] Percent differences use the CARB fossil CNG lookup value of 79.21 gCO_2e/MJ.
[92] ICCT explains the flaring baseline for landfill gas and the venting baseline for dairy/organics, which drives the relative CI levels.
[93] We benchmark CI reductions relative to fossil CNG, the reference fuel used in LCFS accounting and the baseline for book-and-claim transportation crediting, aligning with how RNG is marketed for transportation and consistent with prior analyses.
[94] O'Malley et al., *2030 California Renewable Natural Gas Outlook: Resource Assessment, Market Opportunities, and Environmental Performance*.

resource is available as RNG[95]. These projects can also create revenue streams for site owners/operators through energy sales and policy incentives (e.g., RFS/LCFS), subject to market and program eligibility[96]. AD can also reduce odors and pathogens compared with typical manure storage and, with additional digestate treatment, enable recovery of nutrients and process water. At landfills, gas collection and control systems capture methane along with other organic compounds. Combustion in flares or engines destroys most non-methane organic compounds—including hazardous air pollutants and volatile organic compounds (VOCs) [97]. Flaring typically destroys more than 99% of methane, lowering health risks relative to uncontrolled releases, although collection efficiencies commonly range from about 60–85%, so some emissions remain[98].

Water Use/Reclamation

In Arizona, where chronic water scarcity, groundwater overdraft, and rising wastewater treatment costs intersect, AD of animal manure and food waste can achieve water benefits in addition to methane reduction and energy production. When compared with conventional manure management, landfilling, or sewer disposal of food waste, well-designed AD systems can reduce overall freshwater demand, enable reuse of treated liquid streams, and recover new water through biogas upgrading and advanced digestate treatment, making them particularly well suited to arid and drought-prone regions.

AD can reduce net water demand by minimizing the need for dilution, flushing, and long-distance hauling of wet organic wastes. Dairies and feedlots commonly reuse digestate liquids for manure flushing, equipment wash-down, and digester make-up water, displacing the use of groundwater or municipal supplies. For food waste generators, diverting organics to AD instead of sewer systems reduces biochemical oxygen demand and solids loading at wastewater treatment plants, which in turn lowers treatment-related water and energy intensity. These water savings are especially relevant in Arizona, where both agricultural producers and municipalities face tightening water allocations and rising treatment costs (U.S. EPA, 2022; USDA, 2021).

AD also enables the reuse of treated digestate liquids as a form of reclaimed water. After separating the solids and appropriate treatment, digestate liquids can become a resource for non-potable applications such as agricultural irrigation, dust control, industrial process water, and on-farm operational needs. Because nutrients remain in the liquid fraction, reuse can simultaneously deliver water and fertilizer value, reducing demand for synthetic inputs. Multiple studies have found that

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95 United States Environmental Protection Agency, “Basic Information about Landfill Gas,” Overviews and Factsheets, United States Environmental Protection Agency, September 12, 2025, https://www.epa.gov/lmop/basic-information-about-landfill-gas.
96 United States Environmental Protection Agency, “Project Planning and Financing,” Overviews and Factsheets, United States Environmental Protection Agency, December 22, 2014, https://www.epa.gov/agstar/project-planning-and-financing.
97 United States Environmental Protection Agency, “The Benefits of Anaerobic Digestion,” Overviews and Factsheets, United States Environmental Protection Agency, March 5, 2025, https://www.epa.gov/agstar/benefits-anaerobic-digestion.
98 United States Environmental Protection Agency, “Continue to Operate Gas Collection System and Flare.”

digestate reuse can be compatible with state reclaimed-water frameworks when managed with appropriate controls for pathogens, salts, and nutrients, making it a practical complement to existing water reuse programs in the Southwest (WEF, 2019; EPA AgSTAR, 2023).

Finally, AD can recover new water streams that otherwise would be lost. Biogas upgrading to RNG removes and condenses water vapor, creating a small but continuous source of recoverable water for on-site reuse after minimal polishing. More significantly, advanced digestate treatment systems—including membrane filtration and reverse osmosis—can separate clean water from nutrient concentrates, reducing the volume of liquid requiring land application or disposal while producing a reusable water stream. This opportunity is particularly compelling for food waste digestion, as food waste typically contains 70–90% water; AD enables stabilization, treatment, and reuse of that embedded water locally rather than losing it in landfills (IEA Bioenergy, 2020; EPA AgSTAR, 2023).

RNG in Heavy Duty Fleets: Air Quality Considerations:

Phoenix–Mesa remains in nonattainment for the 2008 and 2015 8-hour ozone standards[99], so local air-quality planning continues to emphasize reductions in smog-forming nitrogen oxides (NO_x) from trucks and buses. NO_x contributes to the formation of ground-level ozone (O_3), a toxic air pollutant that is very harmful to human health, significantly reduces crop yields[100], and is the main component of smog. In fleet applications, RNG can fuel natural gas vehicles that use near-zero-NOx natural gas engines. When these vehicles replace pre-2013 diesel trucks and buses, they can reduce smog-forming NO_x and diesel particulate exposures relative to the older-diesel baseline[101] the same benefit as fossil based natural gas, improving local air quality and reducing respiratory risk in communities with heavy truck traffic relative to diesel[102,103].

Since 2010, new U.S. heavy-duty engines must meet a NO_x limit of 0.20 grams per brake-horsepower-hour (g/bhp-hr)[104], and since 2007, they must meet a particulate matter (PM) limit of 0.01 g/bhp-hr[105]. Arizona enforces these standards[106], and continued reductions in NO_x from trucks

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[99] Arizona Department of Environmental Quality, "Phoenix - Mesa | Ozone Nonattainment Area," Arizona Department of Environmental Quality, accessed October 15, 2025, https://azdeq.gov/phoenix-mesa-ozone-nonattainment-area.

[100] Climate and Clean Air Coalition, "Tropospheric Ozone," accessed June 15, 2026, https://www.ccacoalition.org/short-lived-climate-pollutants/tropospheric-ozone

[101] California Air Resources Board, *In-Use Emission Performance of Heavy Duty Natural Gas Vehicles Lessons Learned from 200 Vehicle Projec* (California Air Resources Board, 2021), https://ww2.arb.ca.gov/sites/default/files/2021-04/Natural_Gas_HD_Engines_Fact_Sheet.pdf.

[102] California Air Resources Board, "Summary: Diesel Particulate Matter Health Impacts," accessed October 15, 2025, https://ww2.arb.ca.gov/resources/summary-diesel-particulate-matter-health-impacts.

[103] California Air Resources Board, *Facts about the Low NO x Heavy-Duty Omnibus Regulation* (Sacramento, California, n.d.), https://ww2.arb.ca.gov/sites/default/files/classic/msprog/hdlownox/files/HD_NOx_Omnibus_Fact_Sheet.pdf.

[104] Regulators express engine emission limits as "grams per brake-horsepower-hour" (g/bhp-hr): the grams of a pollutant an engine emits for each hour it delivers one brake horsepower on a standardized test. Lower numbers mean less pollution per unit of work

[105] United States Environmental Protection Agency Office of Transportation and Air Quality, *Regulatory Announcement* (United States Environmental Protection Agency Office of Transportation and Air Quality, 2020), https://www.eesi.org/files/f00057.pdf.

[106] Maricopa County, "Air Quality," accessed October 15, 2025, https://www.maricopa.gov/2710/Air-Quality.

remain important for improving ground level ozone conditions in the Phoenix–Mesa region [107]. Some natural gas engines marketed as "near-zero NO_x" have a certification meeting the 0.02 g/bhp-hr standard under a California optional pathway; manufacturers sell these engines nationally[108], and EPA programs (e.g., Diesel Emissions Reduction Act grants) recognize them for higher funding[109]. CARB's on-road testing found that 0.02 g/bhp-hr–certified natural gas engines averaged about 0.07 g/bhp-hr across real-world routes, compared with about 0.38 g/bhp-hr for .20 bhp-hr-certified engines. CARB attributed the difference between certification levels and in-use emissions real-world duty cycles, such as frequent idling, maintenance, and accumulated mileage, which raises NO_x emissions. Furthermore, emission devices degrade over time, thus on-road emissions can exceed certification values if not properly accounted for[110]. These findings underscore the need to evaluate NO_x reductions using on-road performance when assessing Arizona's ozone strategy.

Because PM emissions have been capped, since 2010, at 0.01 g/bhp-hr for all new heavy-duty engines[111], most additional PM emissions reductions come from retiring or retrofitting pre-2010 diesel equipment rather than from differences among new technologies[112]. Federal and state programs emphasize scrapping pre-2010 diesel trucks and replacing them with cleaner platforms, including cleaner diesel technologies, near-zero natural gas or RNG trucks, and zero tailpipe emissions technologies such as vehicle electrification[113,114]. Energy Vision's 2025 analysis of 31 populous U.S. counties estimates that replacing ~130,000 pre-2013 diesel trucks with new natural gas vehicles, which could be fueled by RNG, would deliver ~88% of the air-pollution health benefits of replacing them with heavy-duty EVs, preventing >100 deaths and 230 emergency room visits for respiratory issues annually[115]. See Table 12 for a breakdown of these numbers and their relevance for Arizona.

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[107] Maricopa Association of Governments, "Ozone – A Complex Problem in the Maricopa Region," Maricopa Association of Governments, accessed October 15, 2025, https://azmag.gov/Programs/Environmental/Ozone-A-Complex-Problem-in-the-Maricopa-Region.
[108] "ISL G Near Zero," Sales, Cummins Inc., accessed October 17, 2025, https://www.cummins.com/engines/isl-g-near-zero.
[109] United States Environmental Protection Agency Office of Transportation and Air Quality, *How to Identify Low NOx Certified Engines Diesel Emissions Reduction Act (DERA) Grants Fact Sheet* (United States Environmental Protection Agency Office of Transportation and Air Quality, 2020), https://www.epa.gov/sites/default/files/2020-02/documents/420f20010_0.pdf.
[110] California Air Resources Board, *In-Use Emission Performance of Heavy Duty Natural Gas Vehicles Lessons Learned from 200 Vehicle Projec*.
[111] California Air Resources Board, *Updated Informative Digest: Proposed Amendments to the Heavy-Duty Engine and Vehicle Omnibus Regulation* (California Air Resources Board, 2023), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2023/hdomnibus2023/hd-omnibus_uid.pdf.
[112] True The Real Urban Emissions Initiative, *Exposure to Air Pollution from Diesel Trucks in New York City* (True The Real Urban Emissions Initiative, 2022), https://trueinitiative.org/wp-content/uploads/2024/11/true-nyc-fact-sheet-fv.pdf.
[113] United States Environmental Protection Agency, "Biden-Harris Administration Announces $125 Million to Upgrade Older Diesel Engines to Cleaner and Zero-Emission Solutions That Are Better for Our Communities," United States Environmental Protection Agency, October 18, 2024, Florida, https://www.epa.gov/newsreleases/biden-harris-administration-announces-125-million-upgrade-older-diesel-engines-0.
[114] Maricopa County, "Clean Diesel Program," Maricopa County, September 25, 2025, https://www.maricopa.gov/4509/Clean-Diesel-Program.
[115] Michael S. Lerner, *A Path To A Healthier America: Ditching Old Diesel Trucks* (Energy Vision, 2025), https://energy-vision.org/wp-content/uploads/2025/03/ditching-diesel.pdf.

Table 12: NOx/PM Benchmarks, Air Quality Impacts, and Ozone/Health Relevance for Arizona

Metric	Representative Value / Status	Ozone/Health Relevance for AZ
Federal NO_x limit for new heavy-duty engines (since 2010)	0.20 g/bhp-hr	Arizona enforces federal standards; sets the baseline for compliance.
Federal PM limit for new heavy-duty engines (since 2010)	0.01 g/bhp-hr	Keeps diesel particulate exposures low in new fleets.
"Near-zero NO_x" certification value (optional CA pathway)	0.02 g/bhp-hr	These engines are sold nationally and recognized by EPA programs (e.g., DERA) for higher funding.
On-road NO_x from 0.02-certified natural gas (engines (real-world routes)	~0.07 g/bhp-hr	Demonstrates in-use performance well below the 0.20 g/bhp-hr federal cap and below older diesel baselines.
On-road NO_x from 0.2-certified natural gas engines (real-world routes)	~0.38 g/bhp-hr	Demonstrates in-use performance well above the 0.20 g/bhp-hr federal cap and below older diesel baselines.
Phoenix–Mesa ozone attainment	Nonattainment for 2008 and 2015 8-hour standards	Cutting NO_x from trucks supports ozone control in Maricopa County and neighboring areas.
Pre-2010 diesel trucks vs. post-2010 engines	Pre-2010 emit far higher NO_x and PM	Policy initiatives prioritize retiring the oldest vehicles to maximize health benefits.
Health impacts avoided by targeted RNG deployment (Energy Vision 2025)	Replacing ~130,000 pre-2013 diesels with new RNG trucks ≈ 88% of EV air-pollution health benefits	Estimated >100 fewer deaths and 230 fewer respiratory ER visits per year across 31 populous counties, including Pima and Maricopa Counties.

2. Economic Benefits of RNG

RNG can substitute for fossil natural gas in buildings and industry and can fuel natural gas vehicles, including heavy-duty trucks and buses that would otherwise run on diesel in the same applications. Since pipeline-quality biomethane known at RNG is interchangeable with fossil-based natural gas, it can be injected into natural gas pipelines and used in existing end-use equipment—leveraging current infrastructure—while projects still need site-level upgrading and a pipeline interconnection[116]. Because policy-driven credit markets set premium prices for RNG used in on-road transportation, project revenues can cover capital costs for digesters, upgrading, and pipeline interconnections in many cases[117]; explained in more detail in the next section: *Policy, Regulatory, and Market Considerations*. RNG use in U.S. transportation has increased in recent years. In 2024, RNG supplied approximately 86% of all on-road fuel used in natural gas vehicles (The Transport Project),[118] and in California (the largest NGV market, the share reached ~99% in 2024[119][120]. Total natural gas motor fuel was 675M gasoline-gallon equivalents (GGE)[121], of which 531M GGE were RNG.

Global commodity markets remain exposed to shocks that can trigger price spikes[122], so communities benefit from diversified local options. Using locally produced RNG relies on continuously available in-state feedstocks, which can support fuel security. RNG development can also contribute to home-grown energy supply and local economies by driving construction of upgrading plants, fueling stations, and related infrastructure. These projects create skilled jobs in building and operating digesters, upgrading systems, and pipeline injections and monitoring[123][124]. An industry assessment estimated about 22,600 U.S. RNG jobs in 2021; To build 800 additional RNG facilities by 2030 would create a total of about 121,000 jobs[125].

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[116] United States Environmental Protection Agency, *An Overview of Renewable Natural Gas from Biogas*, EPA 456-R-20-001 (United States Environmental Protection Agency, 2020), 47, https://www.epa.gov/sites/default/files/2020-07/documents/lmop_rng_document.pdf.

[117] International Council on Clean Transportation, *Case Studies: The Project Economics of Producing Renewable Natural Gas or Electricity and the Impact of Policy Incentives* (International Council on Clean Transportation, 2023), https://theicct.org/wp-content/uploads/2023/05/case-studies-california-rng-outlook-2030-may23.pdf.

[118] Dan Gage, "Renewable Natural Gas Breaking Motor Fuel Usage Records," April 24, 2024, https://transportproject.org/2024/04/24/renewable-natural-gas-breaking-motor-fuel-usage-records-2/.

[119] The Transport Project and The RNG Coalition, *Decarbonizing California Fleets with Renewable Natural Gas (RNG) Transportation* (2025), https://transportproject.org/wp-content/uploads/2025/08/TP-RNG-CA-Decarbonize-Final-8-28.pdf.

[120] Arizona does not publish a statewide RNG share for NGV fuel. Public datasets (DOE and EIA) track station counts and NGV consumption but do not disaggregate RNG vs. fossil by state, and so national and California RNG fuel percentages are provided for context.

[121] Based on reported 6.96M Mt of CO_2e displaced by RNG in 2023 converted to diesel gallons equivalent

[122] United States Energy Information Administration Independent Statistics and Analysis, "Global Natural Gas Market May Experience a Tighter Supply-Demand Balance This Winter -," United States Energy Information Administration Independent Statistics and Analysis, November 25, 2024, https://www.eia.gov/todayinenergy/detail.php?id=63804.

[123] United States Environmental Protection Agency, "Renewable Natural Gas."

[124] International Energy Agency, "Special Section: Biogas and Biomethane – Renewables 2023 – Analysis," International Energy Agency, accessed October 24, 2025, https://www.iea.org/reports/renewables-2023/special-section-biogas-and-biomethane.

[125] *Economic Analysis of the US Renewable Natural Gas Industry* (2021), https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/61ba25c889b4fb7566404e6c/1639589328432/RNG+Jobs+Study.pdf.

For agriculture, AD can diversify farm revenue by converting manure to biogas that can be upgraded to RNG[126]. For municipalities, landfill- and wastewater-based projects capture methane and can generate revenue from gas or power sales and create jobs in design, construction, and operations[127]. Analysis from industry sources estimated that the U.S. RNG sector supported over 55,000 jobs in 2024, with projects under construction representing 57% of employment, and $7.2B contributed to national GDP[128]. A 2017 analysis found that California RNG projects yield about 8.5–11.2 jobs per million diesel-gallon-equivalent versus ~1.6 for petroleum refining[129]. As of 2024, industry analysts estimate RNG spending supports ~9.5 jobs per $1M.[130] Taken together, these numbers indicate RNG development tends to support more jobs per unit of fuel and, in many cases, more jobs per dollar of spending than petroleum refining (though estimates differ by region, project design, and modeling approach).

IV. Policy, Regulatory, and Market Considerations

Public incentives for RNG include the federal Renewable Fuel Standard (RFS), which provides a separate credit-based incentive for RNG production by requiring U.S. petroleum refiners and importers to meet annual renewable volume obligations. Compliance is achieved by purchasing renewable fuel, such as RNG, or acquiring tradable credits—Renewable Identification Numbers (RINs)—which reduce the share of petroleum-based transportation fuel in the national supply[131]. Complementing the RFS, Low Carbon Fuel Standard (LCFS) programs in California, Oregon[132], Washington[133], and New Mexico create additional market value for RNG, as these states are the only ones that allow pipeline-injected RNG to earn transportation credits using book-and-claim accounting[134]). Other federal incentives include the §45Z Clean Fuel Production Credit (Section §45Z), now extended through 2029, includes RNG made from North American feedstocks[135]. Voluntary market instruments include Renewable Thermal Certificates (RTCs), which offer an option

[126] United States Environmental Protection Agency, "The Benefits of Anaerobic Digestion."
[127] United States Environmental Protection Agency, "Basic Information about Landfill Gas."
[128] Guidehouse, *Renewable Natural Gas Economic Impact Analysis* (Coalition for Renewable Natural Gas, 2024), https://static1.squarespace.com/static/53a09c47e4b050b5ad5bf4f5/t/67577e1c8695832cc7125f86/1733787172143/2024+RNG+Economic+Impact+Report_FINAL.pdf.
[129] United States Environmental Protection Agency, *An Overview of Renewable Natural Gas from Biogas*, EPA 456-R-24-001 (United States Environmental Protection Agency, 2024), https://www.epa.gov/system/files/documents/2024-01/lmop_rng_document.pdf.
[130] Guidehouse, *Renewable Natural Gas Economic Impact Analysis*.
[131] California Air Resources Board, *Low Carbon Fuel Standard (LCFS) Guidance 19-05* (California Air Resources Board, 2019), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-05.pdf.
[132] Oregon Department of Environmental Quality, *Renewable Natural Gas Reporting Using a Book and Claim Accounting Methodology and M-RETS* (Oregon Department of Environmental Quality, n.d.), https://www.oregon.gov/deq/ghgp/Documents/cfpRenewNGrep.pdf.
[133] Washington State Legislature, "Clean Fuels Program Rule," Washington State Legislature, November 28, 2022, https://app.leg.wa.gov/wac/default.aspx?cite=173-424&full=true&utm_.
[134] United States Environmental Protection Agency, *Guidance on Biogas Quality and RIN Generation When Biogas Is Injected into a Commercial Pipeline for Use in Producing Renewable CNG or LNG under the Renewable Fuel Standard Program*, EPA-420-B-16-075 (United States Environmental Protection Agency, 2016), https://19january2017snapshot.epa.gov/sites/production/files/2016-09/documents/420b16075_0.pdf.
[135] Sidley, "The 'One Big Beautiful Bill' Act – Navigating the New Energy Landscape," Sidley, July 15, 2025, https://www.sidley.com/en/insights/newsupdates/2025/07/the-one-big-beautiful-bill-act-navigating-the-new-energy-landscape.

to reduce carbon dioxide emissions from fossil gas consumption in much the same way voluntary buyers procure Renewable Energy Certificates (RECs) to reduce emissions related to electricity consumption[136]. Outside of incentives, projects also generate revenue from standard commodity gas sales[137].

As Arizona lacks in-state low-carbon fuel standards and does not require gas utilities to procure RNG, in-state production and consumption of RNG would only be eligible to generate RIN credits if used in the transportation sector[138]. Therefore, the realization of most policy-driven value from Arizona-produced RNG derives from federal RFS/§45Z and western clean-fuels markets (e.g., CA/OR/WA/NM programs).

In 2024, the Arizona Corporation Commission (ACC) voted four to one to initiate rulemaking to repeal the state's existing Renewable Energy Standard and the electric and gas energy-efficiency rules[139]. In ACC news releases, supporters of this action characterized these mandates as surcharges that "have cost Arizona ratepayers nearly $3.4B" and said they "benefitted a select few" customers[140]. Absent a state clean fuels requirement, Arizona's RNG development will primarily depend on voluntary private action and federal support going forward rather than state-level mandates. In February 2025, the ACC opened Docket No. G-00000A-25-0029 to request stakeholder comment as part of an inquiry into expanding natural gas infrastructure and storage in the state[141].

In Arizona's non-mandated setting, local governments can and do unlock RNG pathways with climate goals and specific project channels. Phoenix's 2050 transportation goals include reducing transportation emissions by 80% through measures such as investing in EV infrastructure and supporting low-carbon fuel options[142]. Tucson's "Resilient Together" plan targets net-zero municipal emissions by 2030[143]. As mentioned earlier, Phoenix's 91st Avenue wastewater treatment plant already upgrades digester gas to pipeline-quality RNG that is sold into transportation markets under the federal RFS. Southwest Gas Corporation's RNG producer/interconnection tariff (approved in 2018) lets RNG producers physically interconnect and deliver gas without creating a utility purchase obligation, therefore facilitating third-party projects[144]. Voluntary corporate buyers are

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136 Green-e, "Green-E® Renewable Fuels," Green-e, https://www.green-e.org/programs/renewable-fuels/.
137 United States Environmental Protection Agency, "Project Planning and Financing."
138 David McCullough et al., "Revving Up: Eight States in Gear with Low-Carbon Fuel Standard Legislation," Pillsbury, April 17, 2024, https://www.pillsburylaw.com/en/news-and-insights/eight-states-low-carbon-fuel-standard-legislation.html.
139 Valorie Carrico, "ACC Directs Staff to Draft Rules to Repeal Renewable and Energy Efficiency Mandates," Arizona Corporation Commission, *Prod 15.3.8521*, n.d., accessed October 24, 2025, http://azcc.gov/news/2024/02/07/acc-directs-staff-to-draft-rules-to-repeal-renewable-and-energy-efficiency-mandates.
140 Dawnelle Gibson, "Chairman O'Connor and Commissioner Thompson Act to Sunset Energy Surcharges That Have Cost Arizona Ratepayers Nearly $3.4 Billion Dollars," Arizona Corporation Commission, February 8, 2024, https://www.azcc.gov/kevin-thompson/news/2024/02/08/chairman-o-connor-and-commissioner-thompson-act-to-sunset-energy-surcharges-that-have-cost-arizona-ratepayers-nearly-3.4-billion-dollars.
141 Arizona Corporation Commission, "eDocket | Arizona Corporation Commission G-00000A-25-0029," Arizona Corporation Commission, February 10, 2025, https://edocket.azcc.gov/search/docket-search/item-detail/29465.
142 City of Phoenix, "2050 Transportation Goals," https://www.phoenix.gov/administration/departments/sustainability/2050-sustainability-goals/2050-transportation-goals.html.
143 City of Tucson, "City of Tucson Climate Action Hub," City of Tucson, 2025, https://climateaction.tucsonaz.gov/.
144 Southwest Gas Corporation, *Revision No. 316* (Southwest Gas Corporation, 2018), https://www.swgas.com/rate/1409197530238/Revision-No-316-RNG.pdf.

an active demand channel—for example, Phoenix-based Republic Services reports that approximately 20% of its collection fleet runs on RNG under purchase agreements with suppliers[145].

Recent Henry Hub natural gas spot prices ranged from a low of $2.91/MMBtu in August 2025 to a brief high of $7.72/MMBtu as of January 2026 before declining to $2.94/MMBtu in May 2026[146]. U.S. on-highway diesel prices remained steady at ~$3.70/gallon in August 2025 through February 2026, before rising to $5.02/gallon by June 2026[147] (equivalent to ~$37/MMBtu, 12 times the energy-equivalent cost to natural gas[148]). This diesel comparison provides a transportation-fuel benchmark as many RNG transportation projects serve truck and bus fleets that would otherwise rely on diesel. RNG competes in transportation-fuel markets while retaining an underlying natural-gas commodity value; RNG project revenues are not determined by diesel or natural gas prices alone; but depend heavily on RIN and LCFS credit values.

Independent analysis from Waste Management Company (WM) of a large landfill-to-RNG case in California found the project's value was due to "favorable LCFS and RIN credit values," with an average blended RNG sales value of ~$31/MMBtu in 2025[149]. For 2026, WM expects approximately 60% of RNG volumes to secure multi-year contracts at about $27/MMBtu, with the remaining 40% selling at an overall blended average price of about $26/MMBtu)[150]. This expectation reinforces how most of the realized $/MMBtu value comes from policy-linked transportation credits rather than the underlying gas commodity[151].

Program design details matter for Arizona producers selling into external markets. Nearby California's LCFS explicitly allows book-and-claim accounting for pipeline-injected RNG used as transportation fuel, meaning environmental attributes can be claimed where the credits are generated rather than where the fuel is produced (subject to anti-double-claim safeguards and retirement of attributes)[152]. New Mexico's 2024 law creates a state credit market by setting a CI standard and authorizing generation, trading, selling, and retiring of credits; the Environmental Improvement

[145] *Sustainability in Action: 2024 GRI Report* (Republic Services, n.d.), https://www.republicservices.com/sites/default/files/legacy_documents/sustainability_reports/Republic-Services-GRI-Report-2024.pdf.
[146] United States Energy Information Administration, "Henry Hub Natural Gas Spot Price (Dollars per Million Btu)," United States Energy Information Administration Independent Statistics and Analysis, October 22, 2025, https://www.eia.gov/dnav/ng/hist/rngwhhdm.htm.
[147] United States Energy Information Administration, "Petroleum & Other Liquids: Gasoline and Diesel Fuel Update," United States Energy Information Administration Independent Statistics and Analysis, June 9, 2026, https://www.eia.gov/petroleum/gasdiesel/index.php.
[148] Calculated via United States Energy Information Administration natural gas and diesel values, $3.69/gal (June 2026) converts to ≈ $40.76 using 137,381 Btu/gal (i.e., $5.60 ÷ 0.137381 MMBtu/gal).
[149] "WM Announces Fourth Quarter and Full-Year 2024 Earnings," Media Room | WM, January 29, 2025, https://mediaroom.wm.com/2025-01-30-WM-Announces-Fourth-Quarter-and-Full-Year-2024-Earnings.
[150] Waste Management Company, "WM Announces Fourth Quarter and Full-Year 2025 Earnings," Business Wire, Business Wire, January 28, 2026, https://www.businesswire.com/news/home/20260128627591/en/WM-Announces-Fourth-Quarter-and-Full-Year-2025-Earnings.
[151] International Council on Clean Transportation, *Case Studies: The Project Economics of Producing Renewable Natural Gas or Electricity and the Impact of Policy Incentives*.
[152] California Air Resources Board, *Low Carbon Fuel Standard (LCFS) Guidance 19-05*.

Board adopted the final rules in late January 2026 for a program start date of April 1, 2026[153]. Oregon also allows book-and-claim for pipeline-injected RNG. To claim RNG for transportation under Oregon's Clean Fuels Program (CFP), reporters must retire Renewable Thermal Certificates (RTCs) in the M-RETS thermal tracking system (to ensure documentation of the environmental attributes and safeguarding against double-claims[154]. Washington likewise permits book-and-claim, but you must retire RTCs/RECs in an electronic tracking system to make a claim; for bio-methane, the rule points specifically to using M-RETS.

At the federal level, Congress enacted the Clean Fuel Production Credit (§45Z) in the Inflation Reduction Act, which provides a per-unit credit for transportation fuels produced in the U.S. with lifecycle GHG emissions at or below 50 kg CO_2e per MMBtu[155]. Final guidance is still pending, but Treasury and the Internal Revenue Service issued guidance in early 2025: the credit scales with emissions performance, facilities that meet prevailing-wage, and apprenticeship requirements qualify for the increased credit amount, and eligible fuels explicitly include RNG. Congress amended the credit with Public Law No. 119-21 on July 4, 2025, which extended §45Z two years from 2027 to now be available through 2029[156], providing more long-term certainty for domestic producers. This extension comes with new constraints: (1) fuel must be produced from feedstocks generated or grown in the U.S., Mexico, or Canada[157] and (2) emissions rates may not be negative[158], except for fuels derived from animal manure, which could receive a negative CI[159,160].

Separate from §45Z, Congress has repeatedly considered—but not enacted—a dedicated incentive for RNG used as motor fuel. Bipartisan "Renewable Natural Gas Incentive Act" bills were introduced in 2023 (H.R. 2448)[161], 2024 (S. 4389)[162], and again in 2025 in both chambers (S. 1252[163] and H.R. 2596[164]). Each version proposed a $1.00-per-gallon credit (or gasoline-gallon equivalent for non-liquid RNG) for RNG sold or used as transportation fuel. For Arizona developers and fleet operators, these proposals reflect that additional RNG transportation fuel incentives remain under consideration at the federal level. However, none of these proposals have been enacted, so project

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153 New Mexico Environment Department, "Clean Transportation Fuel Program," New Mexico Environment Department, October 15, 2025, https://www.env.nm.gov/climate-change-bureau/clean-fuel-program/.
154 Oregon Department of Environmental Quality, *Renewable Natural Gas Reporting Using a Book and Claim Accounting Methodology and M-RETS.*
155 Nicholas E. Buffie, *The Section 45Z Clean Fuel Production Credit* (Congressional Research Service, 2025), https://www.congress.gov/crs-product/IF12502.
156 See Public Law 119–21, § 70521(d) (amending §45Z(g))
157 See Public Law 119–21, § 70521(a)(1)(C) (amending IRC §45Z(f)(1)(A))
158 See Public Law 119–21, § 70521(b)(1)(B) (adding §45Z(b)(1)(E))
159 See Public Law 119–21, § 70521(c)(1)(v)(II) (amending §45Z(b)(1)(B))
160 One Big Beautiful Bill Act, H.R. 1, United States Congress 119th Congress, 1st Session (2025), https://www.congress.gov/bill/119th-congress/house-bill/1/text.
161 Renewable Natural Gas Incentive Act of 2023, H.R. 2448, U.S. House of Representatives 118th Congress (2023–2024) ((Introduced)), https://www.congress.gov/bill/118th-congress/house-bill/2448/text.
162 Renewable Natural Gas Incentive Act of 2024, S. 4389, U.S. Senate 118th Congress, 2d sess. (2024) (2024), https://www.congress.gov/bill/118th-congress/senate-bill/4389/text.
163 Renewable Natural Gas Incentive Act of 2025, S.1252, 119th Congress (2025-2026) (2025), https://www.congress.gov/bill/119th-congress/senate-bill/1252/all-info.
164 Renewable Natural Gas Incentive Act of 2025, H.R.2596, 119th Congress (2025), https://www.congress.gov/bill/119th-congress/house-bill/2596/text.

economics cannot currently rely on the associated revenue. Project viability will continue to hinge on the federal incentives described above and access to external clean-fuels markets (e.g., CA/OR/WA/NM), rather than on in-state mandates. However, near-term offtake assumptions also need to account for competing transportation fuel pathways. Federal policies that accelerate battery EV adoption may influence fleet purchasing decisions and future demand for RNG in transportation applications.

While Congress has signaled ongoing interest in transportation-use of RNG, the broader federal transportation landscape has become less certain since early 2025, particularly for electric vehicles. This policy landscape affects how fleets plan near-term GHG emissions reductions and, by extension, where RNG may remain or emerge as a practical option. On February 6, 2025, the Federal Highway Administration revoked prior National Electric Vehicle Infrastructure guidance as well as suspended approval of state EV-charging plans and new obligations pending revised guidance and plan resubmittals, slowing near-term charging build-out[165]. EPA proposed repealing all federal GHG standards for light-, medium-, and heavy-duty vehicles, creating regulatory uncertainty while the rulemaking is pending. The One Big Beautiful Bill Act, passed in July 2025, officially ended the $7,500 new-EV tax credit as of September 30, 2025, and curtailed other EV credits, adding price uncertainty for fleet transitions[166].

Recommendations: If Arizona chooses to encourage in-state RNG production and use, the state can borrow design features that have worked from other fuel programs, outside of Arizona, adapted to the Arizona context. These options include:

1. Giving credits based on verified lifecycle GHG reductions, with extra value for fuels that deliver very low or negative GHG emissions (e.g., certain waste-based RNG).
2. Allowing "book-and-claim," so that Arizona buyers can count pipeline-injected RNG (tracked by certificates) even if the physical gas flows elsewhere—paired with strict rules to prevent double-counting.
3. Allow limited, time-bound RNG procurement by utilities, with clear cost caps and public reporting to protect ratepayers and build market confidence.

With these conditions in mind, the next section turns to pricing, offtake patterns, and supply growth—further highlighting how technology-enabled landfill gas capture can position Arizona as a low-cost RNG supplier.

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[165] U.S. Government Accountability Office, *Decision: U.S. Department of Transportation, Federal Highway Administration—Application of the Impoundment Control Act to Memorandum Suspending Approval of State Electric Vehicle Infrastructure Deployment Plans*, B-337137 (Washington, DC, 2025), https://www.gao.gov/assets/880/877916.pdf.

[166] Greg Iacurci, "'YOLO'-buying EVs: As $7,500 tax credit ends, consumers may rush to cash in. Here is how to get a good deal", July 10, 2025, https://www.cnbc.com/2025/07/10/trump-big-beautiful-bill-ends-7500-ev-tax-credit-time-to-buy-vehicle.html

V. Market Outlook and Supply Dynamics

Two intersecting trends shape the future of Arizona's RNG market: (1) a national market that is likely to run long on supply through this decade, and (2) technology-enabled opportunities to capture additional landfill gas in-state. Considering both is essential for realistic planning.

1. National Market Offtake and Pricing Trends

As discussed earlier, under the federal RFS, RNG used as transportation fuel can generate D3 RINs[167]. Transportation credit markets such as the RFS and West Coast clean-fuel programs have historically anchored RNG demand, but Energy Vision's ongoing research indicates that the transportation sector is currently approaching saturation. Indeed, RNG accounted for approximately 94% of natural gas vehicle fuel consumption in the U.S. in 2025.[168] In compliance-driven markets, this saturation creates dispenser and fleet constraints and contributes to pricing volatility. D3 RIN prices (which apply to cellulosic biofuels include landfill gas, food waste, and bioresources RNG) declined from a peak of ~$3.40 in 2024[169] to ~$2.57 May 2026 monthly average. Meanwhile, D5 RIN (which apply to advanced biofuels including biogas from waste digesters and non-cellulosic food waste pathways) prices peaked around ~$2.39 in July 2022[170] (due in part to rising global demand for agricultural feedstocks for bio-based fuels[171]) fell to ~$1.00 by November 2025[172], and later rose again to ~$2.10 for May 2026's monthly average[173].

More broadly, EIA attributed the 2026 rise in some RIN prices primarily to higher blending mandates under EPA's 2026–2027 RFS rule[174]. These movements show that RNG project economics can remain sensitive to credit-market conditions, even when its production potential appears technically feasible. The RFS is "nested," i.e., a higher-tier RIN can be used to meet a lower-tier obligation. When cellulosic D3 supply is short, EPA can issue a cellulosic waiver credit. Obligated parties can then comply with the D3 requirement by buying one D5 RIN + one waiver credit in place of a D3; effectively keeping D3 at or below the cost of D5 plus the waiver credit**.** For a

[167] United States Environmental Protection Agency, "Information about Renewable Fuel Standard for Landfill Gas Energy Projects."
[168] The Transport Project, "Drive Fleets Forward", May 2026, https://transportproject.org/wp-content/uploads/2026/05/TP-RNG-Decarbonize-2025-FINAL-5-04-26.pdf
[169] Hoekstra Trading LLC, "D3 Renewable Identification Number (RIN) Price Collapse," Hoekstra Trading LLC, March 24, 2025, https://hoekstratrading.com/tracking-the-cellulosic-d3-renewable-identification-number-rin-price/.
[170] Growth Energy, "RIN Prices Archives," Growth Energy, September 22, 2025, https://growthenergy.org/data-set-category/rin-prices/.[171] Energy Information Administration, "Agricultural Feedstock Costs Drive RIN Prices to All-Time Highs," Energy Information Administration, June 2, 2021, https://www.eia.gov/todayinenergy/detail.php?id=48196.
[171] Energy Information Administration, "Agricultural Feedstock Costs Drive RIN Prices to All-Time Highs," Energy Information Administration, June 2, 2021, https://www.eia.gov/todayinenergy/detail.php?id=48196.
[172] Marcus Seignon, "LCFS & RIN Pricing Report Through November 28th, 2025," AEGIS Hedging, December 1, 2025, https://aegis-hedging.com/insights/lcfs-rin-pricing-report-through-december-1st-2025.
[173] Marcus Seignon, "LCFS & RIN Pricing Report Through May 29th, 2026," AEGIS Hedging, accessed June 24, 2026, https://aegis-hedging.com/insights/lcfs-rin-pricing-report-through-june-1st-2026.
[174] United States Energy Information Administration, "Higher Blending Targets Drive RIN Prices Close to Record Highs," United States Energy Information Administration, June 10, 2026, https://www.eia.gov/todayinenergy/detail.php?id=67765.

comprehensive review to U.S. RFS nesting, pricing, and waiver credits, see Gerveni et al. (2025)[175].

Looking ahead, industry forecasts project that current U.S. RNG supply at ~159 trillion (t)Btu will outpace demand (at 118 tBtu) across most major sectors in the near-term, but a rebalancing of supply and demand by 2030 or sooner. By 2030, the expectation is that RNG demand will rise to 286 tBtu, outstripping projected supply of 268 tBtu[176]. Scenario modeling from AGF shows higher national projected RNG production ranging from 400 tBtu in the Low to over 500 tBtu in the Ambitious scenario, underscoring sizable growth capacity[177]. Together, these scenarios indicate robust supply growth and a shrinking surplus toward the end of the decade, giving producers more options and certainty that there will be buyers for the RNG they produce. For the next 12-36 months, RNG developers, including those in Arizona, are likely to encounter more competitive pricing and an increasing need for durable, multi-year, fixed-price offtake contracts that provide bankable revenue streams required for project financing[178].

An offtake contract is a long-term agreement to purchase a project's output (such as RNG) at agreed terms, creating a predictable revenue stream from a creditworthy buyer[179]. Lenders typically require these multi-year deals to be in place prior to approving debt or equity financing, to secure bankable cash flows for debt repayment and attractive returns on investment.[180] In practice, corporate offtakes of ~10–15 years are common; they usually cover most or all of the loan term, giving lenders confidence that cash flow will be available to make scheduled repayments.[181,182]

2. Pricing Outlook

Arizona RNG today is mostly sold to voluntary pipeline-gas buyers (e.g., utilities, companies, and institutions) purchasing RNG for heating and process use without a mandate[183]. Where feasible,

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175 Maria Gerveni et al., *The Biofuels Blueprint: Understanding the U.S. Renewable Fuel Standard* (2025), https://scotthirwin.com/wp-content/uploads/2025/09/RFS-Blueprint_09092025.pdf.
176 Brian Tracey, *RNG Market Assessment* (Vanguard Renewables, 2025), https://www.ldcgasforums.com/wp-content/uploads/sites/10/2025/04/5Brian_Tracey.pdf.
177 ICF, *Renewable Natural Gas Supply Assessment*, fig. 8.
178 Nina Fahy, *A Fork in the Road for Renewable Natural Gas: Prospects for Non-Transport Growth in the US* (Rabo Bank, 2024), https://www.rabobank.com/knowledge/d011413546-a-fork-in-the-road-for-renewable-natural-gas-prospects-for-non-transport-growth-in-the-us.
179 OPIC, "Important Features of Bankable Power Purchase Agreements For Renewable Energy Power Projects," PPIAF, October 28, 2025, https://www.ppiaf.org/documents/5072.
180 Norton Rose Fulbright, "Energy Transition – New Policy, Existing Structures?," Https://Www.Nortonrosefulbright.Com/Ja-Jp/Knowledge/Publications/D26fef42/Energy-Transition-New-Policy-Existing-Structures, September 2021, https://www.nortonrosefulbright.com/ja-jp/knowledge/publications/d26fef42/energy-transition-new-policy-existing-structures.
181 Divert Inc, "RNG Offtake Agreement with Bp Announced," Press Releases, *Divert*, October 6, 2022, https://divertinc.com/divert-inc-announces-renewable-natural-gas-offtake-agreement-with-bp/.
182 Jacob Wallace, "Vanguard Renewables Strikes Largest Open Market RNG Deal yet with AstraZeneca | Waste Dive," *Waste Dive*, June 14, 2023, https://www.wastedive.com/news/vanguard-astrazeneca-renewable-natural-gas-rng-offtake-agreement/652946/.
183 Chase, "RNG Industry Expects US Voluntary Customers to Spur Demand after Early Transport Boom," S&P Global Commodity Insights, December 16, 2022, https://www.spglobal.com/commodity-insights/en/news-research/latest-news/natural-gas/121622-rng-industry-expects-us-voluntary-customers-to-spur-demand-after-early-transport-boom.

projects also capture California LCFS value by assigning pipeline-injected biomethane to transportation fuel in California via book-and-claim[184]. In the voluntary market, recent discovery shows long-term pricing has fallen from $20–$25/MMBtu to $15-$20/MMBtu for non-dairy RNG, with many projects' normal production costs at ~$15/MMBtu[185]. For landfill-gas RNG, pretax breakeven costs vary widely by site—from approximately $4 to $35 per MMBtu—with an average near ~$15/MMBtu.[186] In Arizona, Southwest Gas Corporation (SWG) publicly emphasizes its role in interconnecting projects and "bringing RNG to market" through its system, pointing to infrastructure enablement as a near-term lever alongside voluntary offtakes[187]. SWG has reported direct purchases of nearly 100,000 MMBtu from Pima County's Tres Rios project since 2021[188].

California's regulator, the Public Utilities Commission, evaluates utility RNG procurements using standardized cost templates at $17.70/MMBtu and $26/MMBtu; Arizona can use these values to gauge price reasonableness and possible rate impacts.[189] Feedstocks with strongly negative lifecycle CI (e.g., dairy manure) command higher effective value in CI-indexed programs[190]. These projects also typically require a higher price to recoup upfront capital and ongoing operating expenses. Because many Arizona projects rely on California LCFS credits for part of their value, effective RNG prices will move with LCFS credit prices; CARB posts a weekly snapshot with the volume-weighted average credit price and price range[191]. In the near term, the most practical utility lever is connecting projects to pipelines; industry reporting notes that developing interconnections is a common way gas utilities enter the RNG value chain[192]. It is also often cited by developers as a major obstacle if/when utility, pipeline operator, and regulatory processes and approvals are not streamlined or cost competitive.

3. Landfill RNG Supply Expansion via Technology-Driven Growth

As discussed earlier in the Landfill section, Arizona's municipal solid waste landfills are identified by EPA as both candidates for energy recovery and home to existing landfill-gas activity, indicating multiple sites where RNG upgrading could be evaluated. Energy Vision's modeling indicates

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[184] California Air Resources Board, *Low Carbon Fuel Standard (LCFS) Guidance 19-05*.
[185] Chase, "RNG Industry Expects US Voluntary Customers to Spur Demand after Early Transport Boom."
[186] Brian Taylor, "Landfill Gas-to-RNG Output Poised to Multiply by 2050," Waste Today, August 13, 2024, https://www.wastetodaymagazine.com/news/landfill-gas-to-marketable-natural-gas-rng-report-wood-mackzenzie-usa/.
[187] "Renewable Natural Gas," Southwest Gas Corporation, accessed October 31, 2025, https://www.swgas.com/en/renewable-natural-gas.
[188] Sean Corbett, "Tres Rios Renewable Gas Center Celebrates One Year Anniversary and Contributions to Reaching Pima County Emissions Goals," October 24, 2022, https://www.swgas.com/en/news/tres-rios-renewable-gas-center-celebrates-one-year-anniversary.
[189] *Southwest Gas Corporation (U 905 G) Updated Cost Procurement Templates*, SWG-03 (2024), https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/R2212011/7721/539999647.pdf.
[190] EcoEngineers, *Life-Cycle Carbon Intensity Analysis Report: Dairy Manure Biogas to Compressed Natural Gas Pathway for Calumet-Dairy Dreams*, Application No. B0096 (n.d.), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0096_report.pdf.
[191] California Air Resources Board, "Weekly LCFS Credit Transfer Activity Reports," California Air Resources Board, accessed October 31, 2025, https://ww2.arb.ca.gov/resources/documents/weekly-lcfs-credit-transfer-activity-reports.
[192] Tom DiChristopher, "Gas Utilities See Renewable Natural Gas Investment Opportunities Expanding | S&P Global," S&P Global, August 10, 2023, https://www.spglobal.com/market-intelligence/en/news-insights/articles/2023/8/gas-utilities-see-renewable-natural-gas-investment-opportunities-expanding-76970932.

that three near-term operational options—real-time monitoring and automated tuning of gas collection and control systems (GCCS), earlier installation of GCCS at active working faces, and new GCCS at high-emitting sites—could reduce methane emissions from U.S. municipal solid waste landfills by approximately 49.1% at an estimated fully loaded cost of about $8.35/Mt CO_2e abated. If implemented widely, these measures could add about 93 million MMBtu of RNG per year nationwide. At an assumed value of $20 per MMBtu, this amount equates to approximately $1.86B per year in gross revenue, with average equipment payback periods of less than one year[193]. These estimates exclude capital and operating costs associated with RNG plant construction and operation.

EPA operations guidance underscores that a landfill gas collection system "requires frequent monitoring and operational adjustments to optimize its performance." Regulatory materials under development emphasize working-face controls (e.g., horizontal wells and improved daily cover) as approaches to reduce methane emissions. EPA finds that food waste decays quickly in landfills and is responsible for an estimated 58% of fugitive methane emissions from MSW landfills—making earlier collection in active cells especially impactful where feasible[194]. Where a gas collection system already exists, EPA notes that this capability improves the economics of adding an LFG energy project (including RNG upgrading), which can lower incremental capital relative to a greenfield system. On the demand side, Arizona has not enacted a clean fuel (LCFS/CFS) program, while California, Oregon, Washington, and New Mexico operate such programs that credit low-carbon fuels. In these programs, pipeline-injected RNG can earn credits using book-and-claim accounting, which enables gas produced in one state to be matched to transportation use elsewhere.

4. Implication for Arizona

With many candidate landfills and proven operational measures to raise capture efficiency, Arizona operators can evaluate site-specific opportunities to increase gas recovery and improve project economics; cost-effectively capturing more gas to then monetize as RNG may become an increasingly attractive option for developers/operators. Recent developments in California and Colorado suggest that other states – including Arizona – could pursue regulatory and policy measures that either incentivize and/or require advanced landfill technology. But even absent government involvement, the stand-alone business case for doing so may be sufficient to drive investment.

5. Recommended Actions for RNG Supply-Demand Balance

Arizona's most practical path is to treat landfill RNG primarily as a near-term methane-mitigation tool with potential for value in future clean-fuel applications. Several actions emerge from this assessment as particularly relevant to future RNG developments in Arizona:

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193 Lerner, *Leading With Landfills*.
194 United States Environmental Protection Agency, *Quantifying Methane Emissions from Landfilled Food Waste* (United States Environmental Protection Agency, n.d.), https://www.epa.gov/land-research/quantifying-methane-emissions-landfilled-food-waste.

- Focus on verifiable capture performance; support and pilot early-collection and real-time system optimization at representative sites, require independent metering, and publish transparent, project-level performance data.
- Streamline permitting and utility interconnections for collection and upgrading projects while setting clear, performance-based guardrails for air, water, and community impacts.
- Enable producers to send their gas to the highest-value markets, whether in-state or out-of-state credit systems, while preventing double counting through standardized book-and-claim and reporting requirements.
- Protect ratepayers through competitive procurement or capped incentives that are tied to independently verified net methane reductions; exclude projects that fail to meet defined cost-effectiveness thresholds (e.g., \$/Mt CO_2e abated).
- Establish a periodic review cycle so Arizona can adjust incentives and safeguards as federal rules and regional markets evolve.

This approach would accelerate methane recovery in the near term, maintain future options for transportation and industrial emissions reductions, and support economic, environmental, reliability, and societal goals.

VI. Conclusion

Arizona possesses a potentially significant RNG resource base associated with landfills, dairy operations, wastewater treatment systems, food waste, woody biomass, and other organic resource streams. The scale, technical maturity, environmental performance, and economic viability of these pathways vary across resource types, project configurations, infrastructure conditions, and market structures. As a result, RNG development opportunities in Arizona cannot follow a single model or deployment pathway.

This assessment indicates that landfill gas and selected manure-based pathways currently represent the most commercially mature RNG opportunities in Arizona under existing market and policy conditions. Large landfill facilities and concentrated dairy operations provide the strongest near-term opportunities for methane capture and RNG production, particularly where infrastructure access and transportation fuel markets align favorably. Wastewater treatment systems and food waste can provide complementary opportunities in selected locations, while woody biomass and selected H_2-related pathways currently face greater technical, infrastructure, and economic constraints.

RNG can contribute to methane management, resource recovery, fuel diversification, and portions of Arizona's broader emissions-reduction landscape. Environmental performance depends heavily on methane-capture effectiveness, project design, lifecycle accounting assumptions, end-use applications, and operational conditions. Project economics also vary significantly across pathways and remain closely tied to infrastructure access, financing conditions, technology performance, and evolving state and federal policy frameworks.

Arizona's development conditions differ from those of neighboring states in important ways, including resource distribution, infrastructure configuration, water considerations, regulatory structure, and access to premium clean-fuel markets. These differences reinforce the importance of Arizona-specific analysis when evaluating the potential role of RNG within the state's broader energy, environmental, and resource-management landscape.

Future RNG deployment in Arizona will evolve alongside changes in technology maturity, market demand, infrastructure investment, and policy conditions. Continued evaluation of resource availability, lifecycle emissions performance, infrastructure requirements, community impacts, and market dynamics can support more informed decision-making regarding where and under what conditions RNG pathways may provide the greatest value within Arizona.

Table of Tables

Appendix: Calculations and Assumptions

This appendix documents the method used to express select results in **Table 3** and **Table 4** as cars eliminated from the road annually and Arizonan homes powered annually equivalents. These equivalencies serve as a communication tool and do not imply the removal of actual vehicles from service or direct powering of homes by RNG. This appendix also summarizes key unit conversions and the sourced assumptions used in the calculations.

1. **How this appendix maps to the tables:**
   - *Table 3 Arizona RNG Sites Breakdown: By Location, Product and Delivery, Production and Reduction, and Livestock Number*: estimates reported emissions reduction yearly in combustion-only CO_2 displacement on an energy-equivalent basis (Mt CO_2/year).
   - *Table 4 Arizona Biogas-to-Electricity Projects: By Location, Product and Delivery, Production and Reduction, and Livestock Number*: converts delivered electricity (kWh/year) to energy (MJ/year) and applies the reported carbon intensity (CI, g CO_2e/MJ) to estimate the annual CO_2e impact implied by that CI (metric tons CO_2e/year), relative to the CI program baseline.
   - **Passenger-vehicle equivalents ("cars eliminated annually")** are determined by estimating the annual emissions reduction (Mt CO_2 for Table 3; Mt CO_2 equivalent where lifecycle CI is used in Table 4) and then dividing by EPA's typical passenger-vehicle emissions factor (Mt CO_2 per vehicle-year).
   - **Interpretation:** When the underlying project metric is CO_2e, converting to "cars" using a CO_2 per vehicle-year factor is a communication approximation to keep the equivalency metric consistent across the tables.
   - We round results for display (e.g., to the nearest hundred) and present them as "X,0000+ cars" where appropriate.

<u>*General formulas (car equivalents):*</u>

- Table 3 (MMBtu-based, combustion CO_2 displacement):
  - Avoided CO_2 (Mt/yr) = RNG (MMBtu/yr) x 53.06 (kg CO_2/MMBtu) ÷ 1000 (kg/Mt)
  - Cars (cars/yr) = Avoided CO_2 (Mt/yr) ÷ 4.6 (Mt CO_2 per vehicle-year)
- Table 4 (CI-based, CO_2e relative to CI program baseline):
  - Annual CO_2e (Mt/yr) = Electricity (kWh/yr) x 3.6 (MJ/kWh) x CI (g CO_2e/MJ) ÷ 1,000,000 (g/Mt)
  - Cars (cars/yr) = ABS (Annual CO_2e (Mt/yr)) ÷ 4.6

<u>*General formulas (home equivalents):*</u>

- Table 3 homes (RNG energy):
  - Homes (home-years/year) = RNG (MMBtu/yr) ÷ 100.03 (MMBtu/Arizona home-year)

- Table 4 homes (electricity):
    - Homes (home-years/year) = Electricity (kWh/yr) ÷ (kWh/Arizona home-year)

2. Constants and data sources used

The constants used in the calculations are depicted in Table 13 used for energy conversions and equivalents align with widely used U.S. government references either from Environmental Protection Agency (EPA) or Energy Information Administration (EIA).

Table 13: Constants and Data Sources for Table 3 and Table 4

Constant/Conversion Factors	Value Used	Units	Source
Typical passenger vehicle annual emissions	4.6	Mt CO_2 per vehicle-year	U.S. EPA, Greenhouse Gas Emissions from a Typical Passenger Vehicle[195]
Natural gas CO_2 emission factor (stationary combustion)	53.06	kg CO_2/MMBtu	U.S. EPA, Default CO_2 Emission Factors and High Heat Values for Various Types of Fuel[196]
Average operating heat rate for natural gas (2024)	7,754	Btu/kWh	U.S. EIA, Average Operating Heat Rate for Selected Energy Sources[197]
Average annual residential electricity use (Arizona, derived from average monthly use)	12,900	kWh/home-year	U.S. EIA, Average Monthly Bill—Residential Consumption by State[198], annualized
Electricity-equivalency energy per home-year (Arizona)	100.03	MMBtu/home-year	Derived from EIA AZ residential kWh/home-year × EIA natural gas heat rate ÷ 1,000,000

[195] United States Environmental Protection Agency, "Greenhouse Gas Emissions from a Typical Passenger Vehicle," Overviews and Factsheets, United States Environmental Protection Agency, June 12, 2025, https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle.
[196] Table C-1 to Subpart C of Part 98—Default CO2 Emission Factors and High Heat Values for Various Types of Fuel, 98 40 C.F.R. § pt. 98, subpt. C, tbl. C-1 (2016), https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-98/subpart-C/appendix-Table%20C-1%20to%20Subpart%20C%20of%20Part%2098.
[197] United States Energy Information Administration, *Table 8.1. Average Operating Heat Rate for Selected Energy Sources, 2014 through 2024 (Btu per Kilowatthour)* (2024), https://www.eia.gov/electricity/annual/html/epa_08_01.html.
[198] United States Energy Information Administration, *2024 Average Monthly Bill–Residential (Table 5A)* (United States Energy Information Administration, 2024), https://www.eia.gov/electricity/sales_revenue_price/pdf/table_5A.pdf.

3. **Method 1: Reported RNG Production (MMBtu/yr) to cars eliminated from road annually equivalent (combustion displacement)**

For projects that report annual RNG output in MMBtu/yr, we estimate avoided emissions using a combustion-only displacement assumption: the RNG is assumed to displace an equal amount of fossil natural gas combustion on an energy basis. This approach does not claim upstream (well-to-pipeline) methane leakage benefits; it only reflects direct CO_2 from combustion.

Step 1. Convert RNG energy to avoided CO_2 (combustion-only):

- Avoided CO_2 (kg/yr) = RNG (MMBtu/yr) × 53.06 (kg CO_2/MMBtu).
- Avoided CO_2 (Mt/yr) = Avoided CO_2 (kg/yr) ÷ 1,000.

Step 2. Convert avoided emissions to passenger vehicle equivalents:

- Cars (vehicle-years) = Avoided emissions (Mt CO_2/yr) ÷ 4.6 (Typical passenger vehicle annual emissions in Mt CO_2 per vehicle-year)

4. **Cars Eliminated Annually Equivalent Worked example: Butterfield RNG 1, LLC (reported 300,000 MMBtu/yr)**

Inputs (from Table 3 in the report): Reported RNG production = 300,000 MMBtu/yr.

Step 1. Avoided CO_2 from combustion displacement

- Avoided CO_2 (kg/yr) = 300,000 × 53.06 = 15,918,000 kg CO_2/yr.
  - Avoided CO_2 (Mt/yr) = 15,918,000 ÷ 1,000 = 15,918 Mt CO_2/yr.
  - Rounded for display: approximately 16,000 Mt CO_2/yr.

Step 2. Passenger vehicle equivalents

- Cars (vehicle-years) = 15,918 ÷ 4.6 = 3,460 cars/yr.
- Rounded for display: approximately 3,500 cars/yr (displayed as 3,500+).

5. **Method 2: Biogas-to-electricity projects reported with CI**

For projects that report electricity output (kWh/yr) and a CI in gCO_2e/MJ (e.g., for transportation crediting), we convert energy to MJ and apply the CI directly to estimate annual CO_2e impact.

Step 1. Convert electricity to delivered energy:

- Energy (MJ/yr) = Electricity (kWh/yr) × 3.6 (MJ/kWh).

Step 2. Apply CI to get annual CO_2e

- Annual CO_2e(g/yr) = Energy (MJ/yr) × CI (gCO_2e/MJ).
- Annual CO_2e (Mt/yr) = Annual CO_2e (g/yr) ÷ 1,000,000.

- If the CI is negative, the result is negative, indicating a net reduction relative to the program baseline. For "cars eliminated," we report the magnitude of the reduction in ABS (absolute value).

Step 3. Convert annual CO_2e reduction to cars:

Cars (vehicle-years) = ABS | Annual CO_2e (Mt/yr) | ÷ 4.6.

6. Cars equivalent annually (worked example: Stotz Southern Dairy Digester (electricity + CI))

Inputs (from Table 4 in the main report):

- Electricity = 5,256,000 kWh/year.
- CI = -762.09 g CO_2e/MJ.

Step 1. Convert kWh to MJ

- Energy (MJ/year) = 5,256,000 × 3.6 = 18,921,600 MJ/year.

Step 2. Apply CI and convert units

- Annual CO_2e (g/year) = 18,921,600 × (-762.09) = -14,419,962,144 gCO_2e/year.
- Annual CO_2e (Mt/year) = -14,419,962,144 ÷ 1,000,000 = -14,419.96 Mt CO_2e/year.
- CO_2e reduction (magnitude) = 14,419.96 Mt/year.

Step 3. Convert to passenger vehicle equivalents

- Cars (vehicle-years) = 14,419.96 ÷ 4.6 = 3,134.8 cars/year.
- Rounded for display: approximately 3,100 cars/year.

7. Method 3: Homes powered annually (worked example: Butterfield RNG 1, LLC)

Inputs (from Table 3 in the report):

- Reported RNG production = 300,000 MMBtu/year.

Assumptions (Table 13):

- Average annual residential electricity use (Arizona) = 12,900 kWh/home-year.
- Average natural gas power plant heat rate (2024) = 7,754 Btu/kWh.
- 1 MMBtu = 1,000,000 Btu.

Step 1. Derive the Arizona electricity-equivalency energy per home-year (MMBtu/home-year)

- MMBtu per home-year
  = (12,900 kWh/home-year x 7,754 Btu/kWh) / 1,000,000 Btu/MMBtu
  = 100.03 MMBtu/home-year.

Step 2. Convert RNG energy to "homes powered annually" (home-years/year)

- Homes (home-years/year)
  = RNG (MMBtu/year) / (MMBtu per home-year)
  = 300,000 / 100.03
  = 2,999 home-years/year.
- Rounded for display: approximately 3,000+ homes/year.

8. Method 4: Homes powered annually (worked example: Stotz Southern Dairy Digester (electricity + CI))

Inputs (from Table 4- in the report):

- Electricity = 5,256,000 kWh/year.

*Assumption (***Table 1***):*

- Average annual residential electricity use (Arizona) = 12,900 kWh/home-year.

Step 1. Convert electricity to homes (home-years/year)

- Homes (home-years/year)
  = Electricity (kWh/year) / (kWh per home-year)
  = 5,256,000 / 12,900
  = 407.4 home-years/year.
- Rounded for display: approximately 400+ homes/year.