


Supercharging Net Zero

# Renewable natural gas' potential is too valuable to ignore





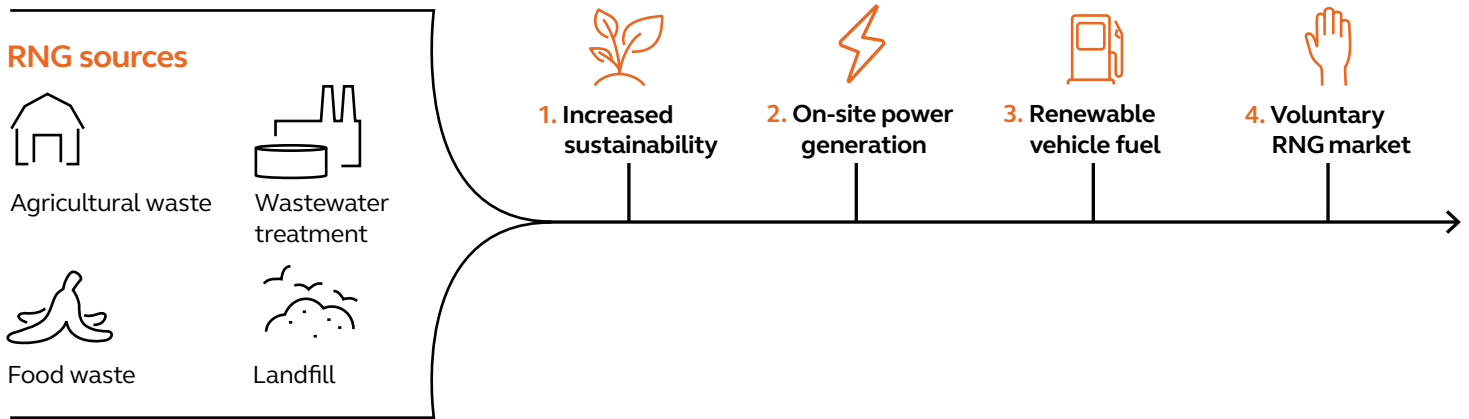


Green energy is on its way, but limitations in current technology, coupled with the timelines and costs for implementation, make full electrification unachievable for many in the near term. Renewable natural gas (RNG), also called biogas, could be the gateway to a smooth transition. Cleaner than traditional fossil fuels and more cost-effective than electric, RNG's evolving value chain is primed with new possibilities.

For utilities, RNG can strengthen business continuity and create new revenue streams amidst the shift to more sustainable business models. On the industry side, RNG can eliminate emissions, reduce energy costs and provide more environmentally friendly industrial feedstocks. No matter where you sit on the chain, there are ways to capitalize.



# Tapping into the RNG value chain



RNG can be sourced many ways: organic food waste, agricultural waste, landfills, water resource recovery facilities (WRRFs) and other organics. How you ultimately use it should depend on what provides the most value to your organization. The science around RNG is ripe with financially viable opportunities that are going unexplored. Seizing them will be crucial to bridging the gap to a green future.

- 1. Increased sustainability.** Capturing RNG in and of itself is a great way to support sustainability goals and protect the environment. Pound for pound, the comparative impact of methane is 25 times greater than carbon dioxide over a 100-year period, and 60% of all methane emissions come from human activities including energy, industry, agriculture and waste management<sup>1</sup>.
- 2. On-site power generation.** RNG can be used to produce power within a facility, creating a more resilient power source and offsetting energy costs.
- 3. Renewable vehicle fuel.** The Renewable Fuel Standard (RFS), a nationwide program for reducing petroleum-based fuels, mandates that fuel sold in the U.S. contains a minimum volume of renewable fuels. Plus, other state-level Renewable Portfolio Standards put a premium on selling renewable vehicle fuel, making it a strong commodity for RNG producers.
- 4. Voluntary RNG market.** Colleges and corporations with aggressive sustainability goals are open to fueling campuses with RNG. For now, the voluntary market typically offers a lower premium but may provide greater price certainty and longevity than the RIN market.



## Case study

# Recycling waste into renewable energy

### Water is fueling innovation with RNG

One area seeing a marked shift in the approach to RNG is WRRFs, which have been using biogas from anaerobic digestion to meet on-site thermal demands and as a fuel for on-site electricity generation for years. There are more than 600 WRRFs using anaerobic digesters as an energy resource in the U.S., with about a third generating electricity for onsite operations.

Nearly 10% of those WRRFs sell electricity to the grid, while only about 2% of the facilities treat biogas to a pipeline quality – allowing the WRRF to inject the treated biogas directly into pipelines<sup>2</sup>. But with financial incentives around biogas-to-electricity waning and maintenance costs with traditional prime movers often proving to be greater than anticipated, more facilities are pivoting to clean gas to pipeline and vehicle fuel quality. We recently partnered with the City of Mesa for a feasibility study on its Food to Energy program, where the WRRF will provide renewable fuel to the city's fleet of solid waste vehicles. Similar plans to derive fuel from WRRFs are underway in Harrisburg, Pennsylvania, and Evansville, Indiana. As fleet transitions like these unfold in all sectors, RNG producers might find partners willing to pay a premium on RNG as vehicle fuel.

### Fueling a fleet with unwanted food waste

The City of Mesa's 966 commercial establishments generate nearly 37 tons of food waste per day. Mesa's leadership is exploring how to make it the basis of a circular food-to-energy program, where the organic waste is sent to WRRFs to create RNG for a fleet of trucks.

To optimize costs and maximize sustainability opportunities, our team helped Mesa study the technical, economic and operational feasibility of converting food waste into useful RNG.

### Designing a circular food-to-energy program

Unlike many cities, Mesa owns and controls its solid waste, water resource recovery and natural gas utilities. The feasibility study investigated the new solutions and operational changes needed to capitalize on that autonomy.

Partnering with Arizona State University, the team analyzed the composition of local food waste and its potential to be processed in anaerobic digesters. With sources identified, our engineers assessed requirements and created concepts for processing food waste into a feedstock that could be effectively

managed at the WRRF. Designs also included updates to two of the plant's anaerobic digesters, giving them the ability to clean biogas into vehicle-quality RNG.

Economics were considered as well. Our specialists collaborated with project partners Raftelis and Energy Vision to identify potential funding sources, such as the U.S. EPA's RFS Program, and develop a comprehensive model to weigh the financial feasibility of operating and capital costs across various scenarios.

### A step toward a local renewable energy source

The study confirmed the benefits of generating RNG, and Mesa is charging into the next phase with its Flare-to-Fuel program. Our experts will upgrade the WRRF to convert the biogas it already produces into RNG, and the resulting RIN credits will build capital for the integration of food waste co-digestion systems in the future. As the program takes off, it will capitalize on RNG's potential to reduce greenhouse gas emissions through the elimination of a known methane source (i.e. landfilled food waste) and by reducing Mesa's reliance on conventional vehicle fuels.





## Bridging the gap to green energy with ... gas?

As more cities and states look to eventually sever ties with fossil fuels, utilities – especially gas utilities – could play a bigger role in the transition than you might expect. Adopting RNG could make electrification affordable for heating- and cooling-dominated regions of the country where full electrification would lead to more use of “dirty power” than current models.

In New York, for example, electrification of heating will nearly triple winter peak demand and increase annual consumption more than 50%<sup>3</sup>. The current grid is not equipped to handle that, threatening outages on the coldest days when customers need power the most. In these cases, RNG could fortify heating capacity to maintain reliable service at peak times using a clean alternative.

We see similar issues with going electric across the country, where technology limitations and a dated grid would require trillions of dollars to upgrade. RNG has shown eye-popping potential

for preserving the environment as battery and grid capabilities advance to more agreeable price points. SoCal Gas’ study on the role of RNG in California’s energy future showed that replacing 16% of the state’s natural gas supply with RNG would cut the same amount of greenhouse gas emissions as converting all buildings to electric-only energy by 2030. Financially, the RNG replacement plan was three times more cost-effective than electrification<sup>4</sup>.

Electrification will not happen overnight. The utilities that innovate alongside green energy will be on the forefront of the sector’s next paradigm: more sustainable business models, controlled rates and greener revenue streams. Becoming proactive will help avoid stranded asset costs and position organizations for innovation opportunities like power-to-gas (a process where the carbon dioxide and carbon monoxide fraction of biogas is converted to methane using electrolyzed hydrogen) as they become more financially viable.



# Finding your place in the industrial RNG landscape

Relationships with the RNG value chain will vary across and within industry sectors. Areas that work with organics, such as food and beverage, could become RNG sellers. Companies that consume a lot of fuel and/or emit greenhouse gases can buy RNG to offset energy costs, reduce carbon footprints and strengthen the resilience of power supply chains.

Certain oil and gas companies will sit in both camps. Petroleum and natural gas networks produce the most methane emissions in the U.S.<sup>5</sup> Incorporating RNG into their distribution networks could be a key factor in honoring sustainability commitments. It could also be used to harvest revenue around companies' fleet transitions and adoption of cleaner fuel alternatives. We have worked with clients that have trouble consistently sourcing alternatives, such as soybean oil for renewable diesel. A steady supply of RNG could help break down organizations' obstacles to achieving a clean energy future.

Other non-energy-related industrial practices can benefit as well. For production of plastics, RNG can be used to create more environmentally friendly feedstock, allowing organizations to maintain production with less worry about fossil fuel dependence and its adverse effects on the environment.



## Farms and landfills can make waste worthwhile

Many farms are already familiar with biogas-to-electricity: In 2020, manure-based anaerobic digesters produced the equivalent of 1.46 million megawatt-hours and reduced greenhouse gas emissions by 5 million metric tons of CO<sub>2</sub> equivalent<sup>6</sup>.

As seen with WRRFs, though, financial and policy trade winds are pushing biogas-to-electricity out of favor. The demand for pipeline- and vehicle-quality gas might make RNG a better investment than producing energy for onsite use. Whether it provides more value to a farm depends on a variety of details, but we have seen more agricultural clients opting to invest in RNG systems as their current biogas-to-electricity equipment reaches the end of its lifecycle. They expect RNG to yield a better return on investment while bridging toward a low-/no-carbon future.

## Recycling organics to accelerate clean energy

In the U.S., municipal solid waste landfills contribute around 15% of human-related methane emissions – the third-largest source behind gas and petroleum networks and enteric fermentation (e.g. digestive gases from cattle)<sup>7</sup>. That gas can be a significant energy resource that accelerates clean energy efforts.

In Chile, for example, our experts helped develop Reciclo Orgánicos, which diverts more than 6,000 metric tons of organic waste from landfills and uses it to supply electricity and vehicle fuel.

The EPA's Landfill Methane Outreach Program consists of energy projects at 500 different landfills, with hundreds more potential candidates identified. Looking at these landfills as pieces of the renewable energy puzzle could help transform more than electrification plans<sup>8</sup>. Capturing the malodorous gases from a site and using them to create RNG or for the generation of electricity would give communities in the vicinity a new avenue for generating revenue and creating jobs – not to mention the day-to-day relief for residents.



## Case study

# Designing a sustainable waste management program in Chile

### Innovating waste into a resource

Chile's landfills emitted 4 million metric tons of greenhouse gases per year, threatening the country's people and ability to meet its Paris Agreement pledge. Seeing the potential for innovating its organic waste streams into clean energy, the country partnered with our sustainability specialists to implement a groundbreaking waste management program: Reciclo Orgánicos.

### A framework for unique recycling solutions

The team outlined a programmatic approach to using compost, anaerobic digestion and landfill gas capture to produce assets for agriculture, energy production and transportation.

Designs supported the technology deployment, greenhouse gas monitoring, capital leveraging and co-financing, and stakeholder engagement for projects in more than 30 communities.

Improvements varied depending on an area's organic recycling potential. Early projects included a new composting plant to manage organic residues in Santa Juana, and processing discarded organics using aerated static piles and GORE® Cover Technology in Talca. In San Felipe, Reciclo Orgánicos is collaborating with a private landfill operator and the local municipal leaders to develop a 2-megawatt landfill gas power plant.

### Building a national strategy for a low-carbon future

Over the first three years of the program, it directly or indirectly reduced 6.65 megatons of CO<sub>2</sub> equivalent. Beyond the measurables, highlighting the connection between organic waste and climate change for Chilean policymakers and citizens inspired Chile's National Organic Waste Strategy. Reciclo Orgánicos will help define the strategy, engage stakeholders and apply technical solutions.

Every project represents a step toward making a low-carbon future a reality. Each successful implementation will provide Chileans with cleaner air, cheaper energy and more sustainable waste management services.



# RNG is a valuable gateway to green energy

Too few organizations realize they sit on the RNG value chain – let alone tap into it. The evolving science around what RNG can deliver in sustainability, resilience and revenue is too great to ignore. As we transition toward a green future, RNG must have its place in the toolbox. Without it, we may miss out on the promising health and environmental potential that broad electrification holds.

## About Arcadis

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### Sources:

<sup>1</sup> "Overview of Greenhouse Gases." U.S. Environmental Protection Agency, <https://www.epa.gov/ghgemissions/overview-greenhouse-gases#methane>.

<sup>2</sup> "Types of Anaerobic Digesters." U.S. Environmental Protection Agency, <https://www.epa.gov/anaerobic-digestion/types-anaerobic-digesters>.

<sup>3</sup> "2021 Load & Capacity Data Report (Gold Book)." The New York Independent System Operator, Inc. <https://www.nyiso.com/documents/20142/2226333/2021-Gold-Book-Final-Public.pdf/b08606d7-db88-c04b-b260-ab35c300ed64>.

<sup>4</sup> "Analysis of the Role of Gas for a Low-Carbon California Future." Southern California Gas Company. [https://www.socalgas.com/1443741887279/SoCalGas\\_Renewable\\_Gas\\_Final-Report.pdf](https://www.socalgas.com/1443741887279/SoCalGas_Renewable_Gas_Final-Report.pdf).

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