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April 4, 2023

ELECTRONIC FILING

Mr. Adam J. Teitzman, Commission Clerk
Office of Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

Re: Docket 20230023-GU, Petition for Rate Increase by Peoples Gas System, Inc.

Dear Mr. Teitzman:

Attached for filing on behalf of Peoples Gas System, Inc. in the above-referenced docket is the Direct Testimony of Lew Rutkin, Jr. and Exhibit No. LR-1.

Thank you for your assistance in connection with this matter.

(Document 5 of 18)

Sincerely,

J. Jeffry Wahlen

cc: Charles J. Rehwinkel, Public Counsel
Jon Moyle, FIPUG
Major Thompson, OGC
Ryan Sandy, OGC

JJW/ne
Attachment

BEFORE THE

FLORIDA PUBLIC SERVICE COMMISSION

DOCKET NO. 20230023-GU

IN RE: PETITION FOR RATE INCREASE

BY PEOPLES GAS SYSTEM, INC.

PREPARED DIRECT TESTIMONY AND EXHIBIT

OF

LEW RUTKIN, JR.

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BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

PREPARED DIRECT TESTIMONY

OF

LEW RUTKIN, JR.

Q. Please state your name, address, occupation and employer.

A. My name is Lew Rutkin, Jr. My business address is 702 North Franklin Street, Tampa, Florida 33602. I am employed by Peoples Gas System, Inc. ("Peoples" or the "company"), as its Vice President of Gas Supply and Development.

Q. Please describe your duties and responsibilities in that position.

A. I lead our Gas Supply and Development team, which performs several functions for Peoples. The team is responsible for ensuring that the company has adequate gas supply and pipeline transportation capacity to serve our growing system and performs our natural gas commodity and transportation trading activities. It manages the company's Natural Choice Transportation Service and Individual Transportation Services programs as approved by the Florida Public Service Commission ("Commission"). It also coordinates the company's system expansion activities for large commercial and industrial

customers, electric power generators, and customers who are interested in using compressed natural gas ("CNG"), liquified natural gas ("LNG"), and renewable natural gas ("RNG") as part of their energy solutions. I will refer to these customers collectively as "Large Customer(s)" in my direct testimony.

Q. Please summarize your educational background and business experience.

A. I began working for our affiliate, Tampa Electric Company ("Tampa Electric"), as a cooperative education student in 2001, graduated from the University of South Florida with a Bachelor of Arts degree in Mathematics in 2003, and then joined Tampa Electric as a risk analyst. I left Tampa Electric in 2005, and from 2005 to 2019 worked for three different competitive energy companies where I performed a variety of functions, including: (1) gas supply management; (2) marketing and trading derivative and physical structures, including exchange futures, fixed-price swaps, basis swaps, swing swaps, storage spreads, exchange options, and forward physical gas; and (3) developing and marketing two interstate natural gas pipeline systems (Gulfstream Natural Gas System and Sabal Trail Transmission pipeline) that serve the state of Florida. I rejoined the TECO Energy family in 2019 as

Director of Gas Supply and Development for Peoples. I was promoted to my current position in 2021.

Q. Please describe the company's Gas Supply and Development team.

A. Peoples' Gas Supply and Development team consisted of 28 team members as of December 31, 2022 and is expected to grow to 38 team members by December 31, 2024. I will discuss the addition of 11 team members between 2023 and 2024 later in my direct testimony, which includes the replacement of one team member that left in January 2023. Approximately half of my team is focused on gas supply, pipeline transportation capacity, resource planning, and gas trading activities. Another portion of my team manages relationships with existing and new Large Customers and another portion is dedicated to supporting customers pursuing LNG, CNG, or RNG options for gas service. Our relationship managers stay alert for opportunities to: (1) serve new customers by expanding our system and (2) serve existing customers who plan to use more gas by expanding our system. I will discuss the growth of the Gas Supply and Development team later in my direct testimony.

Q. What are the purposes of your prepared direct testimony in this proceeding?

A. The purposes of my direct testimony are to: (1) describe the company's system of distribution pipeline, contracted pipeline capacity, and supply arrangements, and how Peoples manage and expand those system assets to serve our growing small and Large Customer base; (2) describe how the company developed our 2024 test year revenue forecast for the Large Customer classes; (3) discuss the major capital projects Peoples is undertaking to serve Large Customers from our last general base rate proceeding to the 2024 test year, (4) describe how the company is investing to support customers who seek innovative CNG, LNG, and RNG energy solutions; and (5) demonstrate that the level of Gas Supply and Development area operations and maintenance ("O&M") expenses in the company's 2024 test year is reasonable and prudent. I will also explain the company's proposed Minimum Volume Commitment Gas Transportation Agreement.

Q. Did you prepare an exhibit to support your prepared direct testimony?

A. Yes. Exhibit No. LR-1, entitled "Exhibit of Lew Rutkin, Jr." was prepared under my direction and supervision and accompanies my prepared direct testimony. The contents of my exhibit were derived from the business records of the company and are true and correct to the best of my information and

belief. It consists of these four documents:

Document No. 1	List of Minimum Filing Requirement Schedules Sponsored or Co-sponsored by Lew Rutkin, Jr.
Document No. 2	Articles on benefits of CNG, LNG, and RNG
Document No. 3	Peoples' RNG Florida Trend Article
Document No. 4	Capital Projects Summary

PEOPLES' DISTRIBUTION SYSTEM

Q. Describe the system of distribution pipeline, contracted transportation capacity, and supply arrangements used by Peoples to serve its customers.

A. Peoples receives natural gas from the Florida Gas Transmission ("FGT"), Gulfstream, Southern Natural Gas Company ("SONAT"), Sabal Trail interstate, and SeaCoast intrastate pipelines and distributes that gas to its customers using a distribution system consisting of gas mains, laterals, and service lines, and ancillary equipment such as meters, regulators, and pressure monitoring equipment. Peoples had approximately 14,900 miles of gas mains in service as of December 31, 2022.

The company purchases gas (the commodity) at market prices

from dozens of suppliers, brokers, and marketers and ensures that it has adequate interstate and intrastate transportation capacity to deliver the gas it purchases to customers on its system. Peoples ensures that it has enough distribution pipeline capacity so customers that purchase gas commodity directly from suppliers, brokers, or pool managers, and transportation capacity from interstate or intrastate pipelines, can receive the gas they buy at delivery points on the company's distribution system. Ensuring that Peoples has adequate gas supply and transportation capacity is an important function of the Gas Supply and Development team. The team works with the company's Operations and Engineering teams to monitor projected and actual demand, pipeline pressures and other operating information to ensure Peoples can serve our customers.

Q. How does the company manage its gas supply and transportation capacity arrangements to benefit customers?

A. The Gas Trading and Transportation group in Peoples' Gas Supply and Development team develops and executes strategies that: (1) lower the overall gas supply costs to our customers and (2) optimize our pipeline transportation agreements to manage risks related to extreme weather events and high gas supply prices. The trading group continuously evaluates ways

to mitigate risk exposure to fuel supply, transportation, and pricing changes that may adversely affect our customers. The company's diverse pipeline transportation portfolio, and our working relationships with large shippers, enable Peoples to meet growing customer demand in a safe and reliable manner, even during extreme weather events, periods of commodity price volatility, and when operational challenges occur.

Q. How does the company identify the need to expand its distribution system or pipeline transportation capacity?

A. In two primary ways. Peoples works with real estate developers to ensure that the company install gas distribution facilities to meet expected demand from residential and small commercial customers and the Gas Supply and Development team works with Large Customers and those seeking to use or develop CNG, LNG, and RNG to plan for and meet the demand in these market segments. Both teams collaborate with our engineering team led by company witness Christian C. Richard to plan the most efficient way to expand our system to meet customer demand for supply and transportation arising from all customer classes. I will discuss the expansion of our facilities to meet Large Customer demand later in my direct testimony. Witness Richard describes the company's planning processes in his direct testimony.

Q. How many Large Customers does Peoples serve?

A. As of December 31, 2022, Peoples served 405 Large Customers which includes 53 industrial and power generation customers. By December 31, 2024, Peoples expect to serve approximately 415 Large Customers, including 61 industrial and power generation customers. The company considers our Large Customer group to include customers that take service under our GS-4, GS-5, WHS, SIS, IS, ISLV, and CIS rate schedules or pursuant to special contracts authorized by the Commission.

Q. Is Large Customer demand for natural gas growing in Florida?

A. Yes. As company witnesses Dr. Richard K. Harper and Helen J. Wesley explain in their direct testimonies, Florida's population growth and economic success has been remarkable, especially over the past few years. Customer interest in sustainable and renewable energy continues to grow and has expanded beyond solar. Although natural gas prices recently have been volatile, the abundant supply of domestic natural gas has reduced the cost of natural gas well below levels a decade ago and has made the United States a major exporter of natural gas. The price of natural gas and its clean energy attributes has made natural gas a cost-effective and environmentally friendly alternative to coal, diesel, heavy

oil, and propane. As of February 28, 2023, as posted on the CME Group's website, the average natural gas price for all future contract months through December 2023 was $3.27/MMBtu. The price of crude oil and propane were $12.96/MMBtu and $9.56/MMBtu respectively as posted on the CME Group's website. In other words, natural gas is currently 65 percent less expensive than the closest alternative. These factors have increased demand for natural gas from Peoples' Large Customers.

LARGE CUSTOMER REVENUE FORECASTING

Q. Please describe how Peoples forecasts therms and base revenue for Large Customers.

A. Forecasting therms for base revenues for Large Customers is a joint effort by the company's Gas Supply and Development team and Finance department. This portion of the company's overall revenue forecast does not require economic modeling and regression techniques like those used by company witness Eric Fox for residential and small commercial customers.

Rather, since a large volume of demand is concentrated in a small number of Large Customers, the company develops its Large Customer demand and revenue forecast by examining prior and expected usage on a customer-by-customer basis. As part

of this process, members of our Gas Supply and Development team communicate with our Large Customers about their planned natural gas usage and transportation needs for the budget period and beyond. Peoples uses customer-specific projected usage and applicable rates and charges to forecast revenues for the customers taking service under our GS-4, GS-5, WHS, SIS, IS, ISLV and CIS rate schedules, or service pursuant to a special contract.

The company includes therms and revenue projections for new Large Customers in our financial forecasts based on the specific service characteristics of the new customer, including projected demand, and the in-service date of any facilities being built to serve a new customer.

Q. Did Peoples use the process described above to forecast revenues from Large Customers in the 2024 test year?

A. Yes. The projected revenues from Large Customers in 2024 are shown on MFR schedule G-2, page 8, which I co-sponsor with Peoples' witness Rachel B. Parsons.

Q. Describe how Peoples prepares the off-system sales forecast?

A. The amount of off-system sales ("OSS") net revenue budgeted

for 2024 at approximately $2.5 million projection was based on historical OSS net revenues. Although in 2022, Peoples had experienced a significant increase in revenues due to favorable natural gas price spreads and higher market demand conditions. These factors resulted in a $3.1 million increase above the budgeted $1.4 million margin to the bottom line. OSS revenues for 2024 are expected to moderate due to lower natural gas prices and less favorable market conditions.

LARGE CUSTOMER SYSTEM EXPANSION AND CAPITAL PROJECTS

Q. How does Peoples determine the need to expand its distribution system to serve Large Customers?

A. The company's internal need determination process for Large Customer expansions begins with communications between members of our Gas Supply and Development team and existing or potential new Large Customers. Our Gas Supply and Development team members routinely communicate with existing and potential new Large Customers to understand whether they can benefit by: (1) building a new facility that uses natural gas, (2) converting existing manufacturing and industrial processes to utilize natural gas, or (3) expanding their existing use of natural gas. Our Gas Supply and Development team members often work with local economic development organizations when they target new large commercial and

industrial businesses for location or relocation within a local area.

Once Peoples understand what a Large Customer needs or wants, the Gas Supply and Development team works with Peoples' operations and engineering teams to determine whether the increased customer demand can be served by existing capacity of our distribution facilities or whether the company needs to construct new distribution infrastructure (considering sufficient upstream transportation capacity) to serve the customer. It also considers the impact of residential and small commercial growth in the area. The key issue in this evaluation is whether the company's existing infrastructure and transportation arrangements can safely and reliably deliver the forecasted volumes and pressures of gas to the customer without impairing safe and reliable service to our existing customers.

If the company can serve the Large Customer's needs with existing distribution infrastructure, Peoples will offer to serve the customer pursuant to the applicable rate schedule and regulations in our tariff. If Peoples must build new distribution infrastructure to serve the Large Customer, members of our Gas Supply and Development team collaborate with the company's engineering team to evaluate the options

for building new infrastructure, identify the most cost-effective way to meet the demand, and develop cost estimates to determine whether the company should offer service under an existing rate schedule or standard contract, or alternatively, enter a special contract with the Large Customer.

The processes described above occurs in concert with the company's overall process of monitoring its distribution system for changes in volumes and pressures, planning to serve forecasted peak demand, complying with new safety requirements, and identifying projects to improve overall system reliability, resiliency, and efficiency ("RRE"). This overall planning process is detailed by witness Richard in his prepared direct testimony.

Q. How does the general body of ratepayers benefit from the addition of Large Customer loads?

A. Large Customers generate annual throughput of at least 250,000 therms, which is equivalent to the annual throughput of approximately 1,000 residential customers. This additional load broadly results in increased system utilization, thus bringing scale benefits to every capital dollar spent by spreading capital costs over larger billing determinants and

thus lowering fixed costs for all rate payers.

Q. What major capital projects has the company constructed to serve Large Customers since its last general base rate proceeding?

A. Peoples has constructed several major capital projects for Large Customers since its last general base rate proceeding, including the FGT to Big Bend Lateral. As part of this project, the company constructed approximately nine miles of transmission pipeline to provide additional gas transportation capacity to Tampa Electric at its Big Bend Power Station. The total cost of the project is being recovered by Peoples from Tampa Electric using a distribution rate that recovers Peoples' revenue requirement on a levelized basis over the life of the contract. This rate base addition was prudent, because it was needed by our customer, was constructed in a cost-effective manner, and is supported by customer specific revenues.

Q. Is the company planning major projects to Large Customers for periods beyond the 2024 test year?

A. Yes. The company is planning to construct pipeline infrastructure facilities to enable the transportation of

capacity from the FGT pipeline in northeast Florida to an LNG facility in the Jacksonville area, that serves the marine industry and others. This project, which Peoples call the FGT to the Jacksonville Export Facility ("JEF") Project, is expected to be under contract by the end of the second quarter of 2023, under construction by the third quarter of 2024, and in-service by the third quarter of 2025, which is later than the company projected in our 2023 and 2024 capital budgets. In addition, the cost estimates for the project in the initial budgets have changed. However, due to its size and the length of time it will take to build, the project will be eligible to accrue an Allowance for Funds Used During Construction ("AFUDC") and the capital cost will not be included in the company's rate base calculation for the 2024 test year. This project is a clear example of how our natural gas infrastructure can enable the cost-effective and carbon-friendly use of natural gas to fuel the marine industry for years to come.

INVESTING IN INNOVATION AND CLEAN ENERGY SOLUTIONS

Q. Is the way customers think about and use natural gas evolving?

A. Yes, natural gas has essentially replaced coal, diesel, and heavy oil as the fuel choice for electric generators in Florida. CNG and LNG have become increasingly popular as

alternative ways to fuel motor vehicle fleets and marine vessels. The abundant, low cost of domestic natural gas and existing natural gas infrastructure have helped position the United States as a significant exporter of natural gas to countries around the world.

In addition, environmental concerns have driven corporate commitments to reduce greenhouse gas emissions across their value chain and increased customer interest in innovative, Florida-sourced, carbon-friendly renewable energy solutions like RNG. As explained in witness Wesley's direct testimony, Peoples is committed to advancing the growth of RNG, LNG, and CNG because: (1) our customers value sustainability and environmental stewardship, (2) sustainable natural gas service is important to the future of Florida, and (3) it is simply the right thing to do. Offering service to support LNG, CNG, and RNG enables Peoples to lead and participate in a cleaner energy future for Florida. These solutions are cost effective and make an immediate impact on emission levels.

Q. What are the environmental benefits of CNG, LNG, and RNG?

A. LNG and CNG use for transportation, results in lower emissions (SO_X, NO_X, and greenhouse gases) compared to fuel oil or diesel. RNG facilities capture and clean methane that would

have ordinarily been emitted to the atmosphere from landfills, wastewater treatment facilities or livestock farms, and conditions this potentially environmentally hazardous waste product into pipeline quality natural gas and transports it for end-use via a pipeline system. Document No. 3 in my exhibit contains a collection of articles explaining the environmental benefits of CNG, LNG, and RNG.

COMPRESSED NATURAL GAS

Q. What role does CNG play in Florida?

A. CNG is growing in popularity as a safe, alternative fuel for fleets of vehicles. Owners and operators of large motor vehicle fleets in Florida are turning to CNG as an affordable and sustainable way to power their vehicles – especially mass transit buses, garbage collection trucks and large trucks. The Jacksonville Transportation Authority plans to convert a large portion of its fleet to CNG by 2023. Major metropolitan transit agencies are expanding their use of CNG. Growth in the CNG market is being driven by the affordability of natural gas, the reliability of natural gas via underground pipelines, the availability of proven gas compression and natural gas engines, and the attractiveness of CNG to entities that seek cost-effective ways to achieve sustainability and carbon reduction goals. The company's sales to CNG filling

stations measured in therms grew 2.1 percent from 2020 to 2021, and 7.7 percent from 2021 to 2022.

Q. How does Peoples serve customers who seek CNG?

A. Peoples currently serves approximately 60 CNG filling stations in Florida. The company owns and operates one CNG facility that provides CNG services for the City of Orlando's refuse trucks. Projects to serve new CNG customers benefit the company and its customers by increasing the throughput of natural gas through the company's system, which in turn increases the volume of gas over which the company's fixed costs can be recovered when setting rates. The company invested about $1.0 million dollars in 2022 to serve new CNG stations and expects to add new CNG customers in 2023 and 2024. It is difficult to predict when CNG customers will seek service from Peoples, and most of them can be served with existing infrastructure, so the company's 2023 and 2024 financial forecasts do not include any capital expenditures specifically for serving new CNG customers. Peoples intends to continue to support local governments, motor vehicle fleet owners, and CNG providers as they seek to develop CNG stations and convert vehicle fleets from gasoline or diesel to CNG.

LIQUIFIED NATURAL GAS

Q. What role does LNG serve in Florida?

A. LNG is quickly becoming very important to Florida's maritime industry for powering vessels (including container ships and the cruise ship industry) and as a cost-effective way to export natural gas around the world. Nine cruise ships that will be fueled by LNG are expected to be served from Florida ports by 2027, and five of those are already in service and operate out of Florida ports. This represents a substantial capital investment in the order of approximately $1.0 billion per vessel by the maritime industry to allow for the conversion of these vessels to use LNG. The peninsular shape of Florida, its geographic location, and the significant and growing water-borne shipping activities operating from Florida's numerous deep-water, high-volume ports make our state attractive for LNG providers.

The aerospace industry is shifting to more sustainable fuels and LNG represents an excellent choice. Space Florida is at the center point for the use of LNG as an aerospace fuel. The space industry has plans to power launch vehicles with LNG for space missions due to its high energy content. With the increase in launches from the space industry, fuel sources are needed nearby to support efficient refueling at launch sites.

Consequently, because LNG is a carbon friendly alternative and provides environmental and economic benefits to customers using it, demand for pipeline infrastructure and LNG facilities to support the economic development of Florida's LNG market is growing. LNG export, marine, aerospace, and rail sectors are developing markets for Florida and LNG.

Q. How does Peoples serve customers who operate LNG facilities?

A. Peoples currently provides natural gas to two operating LNG facilities in Jacksonville, and both facilities plan to expand over the next few years. The company supports these customers by providing gas distribution facilities that deliver industrial quantities of natural gas. Peoples has an LNG service tariff, but the LNG tariff excludes liquefaction services. In most instances, Peoples will be a distribution infrastructure provider to LNG and the company is not proposing to change the liquefaction restriction in its LNG tariff in this proceeding. LNG creates long-term infrastructure for the State of Florida resulting in direct investment in Florida, high-paying local jobs, and promoting economic development in the state. Peoples will continue to support the growing demand for LNG to supply marine and other industries, including natural gas exports to other parts of the world. The availability and expansion of natural gas

distribution systems in Florida, including Peoples, enables the market development of LNG which produces further economic opportunities for our State.

RENEWABLE NATURAL GAS

Q. What is renewable natural gas?

A. RNG is a natural by-product of above-ground decomposing waste, and contrasts with traditional natural gas that was formed underground from decomposing materials over long periods of time. When organic waste from farms, landfills, and wastewater facilities decomposes, it releases methane, a powerful greenhouse gas, into the atmosphere. Naturally occurring methane (CH_4) and carbon dioxide (CO_2) emissions from energy and anthropogenic waste are two of the largest contributors to climate change in the United States. According to the United States Environmental Protection Agency, methane emissions make up about 10.9 percent of the human-caused greenhouse gas (GHG) emissions in the United States.

Q. How do RNG projects work?

A. RNG projects: capture methane from landfills, livestock farms, and wastewater treatment plants; remove the harmful

constituents; condition the natural gas to gas pipeline quality specifications; and inject it into a pipeline system for consumption by natural gas customers. These projects can be considered carbon neutral or carbon negative because they take methane that otherwise would have been emitted into the atmosphere and create clean natural gas which can be injected into Florida's pipeline system. RNG is unique as a fuel source because it simultaneously reduces greenhouse gas (GHG) emissions from both methane and carbon dioxide on a net basis.

Q. What role can RNG play in the energy future for Florida?

A. RNG can be an important part of a sustainable, reliable, and affordable energy future for Florida and can provide real benefits.

Rather than generating out-of-state jobs to extract traditional natural gas and deliver it to Florida, RNG projects developed in Florida are local investments that create local jobs and promote economic development in Florida, not elsewhere.

RNG can contribute diversity to the state's fuel portfolio, providing Floridians with a local fuel source that displaces natural gas that would otherwise be supplied from outside the

state. Having localized and distributed RNG supply increases the resiliency of Florida's natural gas distribution system and mitigates the risks associated with potential pipeline or upstream supply disruptions.

RNG is a natural complement to solar and other renewable energy options like wind. These renewable options are intermittent energy sources dependent upon weather conditions, so RNG can be used to generate electricity and maintain the reliability of the electric supply system when the weather or time of day is not favorable for other renewable options.

RNG can also bring added reliability and resiliency to underserved or hard-to-serve rural areas because it can be sourced and produced locally.

Q. How will Peoples support the development of RNG in Florida?

A. Peoples' size, the resources available to it, the expertise of its team members, and the size and reach of its distribution system uniquely position Peoples to support the growth of RNG in Florida. The statewide reach of the company's existing gas distribution system is near landfills, wastewater treatment plants, and livestock farms that are

potential RNG production sites. Peoples is actively working with RNG developers and facility owners to evaluate RNG potential at sites throughout the state. The company is making investments to support RNG using our renewable natural gas tariff Rate Schedule Renewable Natural Gas Services ("RNGS").

Q. What investments has Peoples made in RNG?

A. Peoples is investing approximately $62.0 million to support or construct three of the first operating RNG facilities in Florida, namely New River RNG, Brightmark RNG and Alliance Dairies RNG. A general description and illustration of the company's RNG activities are included in Document No. 4 of my exhibit.

Q. When will these three RNG projects be in-service?

A. Absent unforeseen circumstances, Peoples expects these three projects to be in service by the time this rate proceeding goes to final hearing. Once in service, these projects will generate enough RNG to serve approximately 40,000 residential customers, or approximately ten percent of the company's residential customers.

Q. Are the three RNG projects the same?

A. No. The projects are different and reflect the suite of services Peoples can provide to support RNG development. Two of the projects, Brightmark and New River, which I discuss later, use the company's Rate Schedule RNGS and cost of service pricing to support the efforts of two RNG developers.

Alliance Dairies is a unique project between a dairy owner and Peoples, under which Peoples has made rate base investments in RNG facilities and will recover its capital investment through a revenue-sharing arrangement with the farmer that monetizes the environmental attributes arising from the project. I will explain each of these projects in more detail.

NEW RIVER RNG PROJECT

Q. Please describe the New River project.

A. The New River RNG project was developed under the company's RNG tariff and provides cost of service-based recovery to Peoples for the facilities required to transport RNG produced and conditioned at the New River landfill into Peoples' pipeline system. Peoples will test the RNG to be produced by the landfill to ensure that it meets pipeline quality standards before it is injected into our gas distribution system and then on to the FGT interstate pipeline. Peoples

expects the peak daily amount of RNG to be transported through our system from New River will be equivalent to the daily natural gas demand of approximately 30,000 residential customers.

Q. Please describe the contract that governs the New River project.

A. The Renewable Natural Gas Services Agreement ("RNGSA") that governs the relationship between the operator of the New River RNG conditioning facility, Opal Fuels, is a cost-of-service agreement which fully recovers the investment by Peoples over a 20-year term. The agreement includes guarantees and firm commitments by Opal Fuels to meet the full revenue requirements of the project. Peoples will not own the environmental attributes generated by the project; they will be owned by the developer, who can market the environmental attributes at its discretion. Opal Fuels will own the title to the gas produced at the facility and will sell it in the open market.

Q. What is the projected in-service date for the New River project?

A. The total capital investment made by Peoples for the New River

project is approximately $8.2 million. The project is in-service, operating and transporting RNG.

Q. Is the company's investment in facilities to serve the New River RNG facility prudent?

A. Yes. The company's New River Project RNG is prudent. It was constructed to meet a specific customer need and the revenue requirement associated with the project will be recovered over the life of the contract via payments from the customer. Although the RNG generated by the project will not be owned by Peoples, the New River RNG project will generate the environmental, resiliency, and other RNG benefits previously described in my direct testimony.

BRIGHTMARK RNG PROJECT

Q. Please describe the Brightmark RNG project.

A. The Brightmark RNG project was developed under Peoples' RNG tariff and is composed of RNG collection, conditioning, and transportation facilities required to transport RNG produced and conditioned at the Larson Dairy Farm into the FGT and Florida Southeast Connection interstate pipeline systems. Peoples will test the RNG produced by the project to ensure the gas specifications meet the requirements of each

respective interstate pipeline system before injection. Peoples expects the peak daily amount of RNG to be transported through our system from Brightmark will be equivalent to the daily natural gas demand from about 8,000 residential customers. Peoples will not own the environmental attributes created by the project; they will be owned by the developer, who can market them at their own discretion. Brightmark will own title to the gas produced at the facility and will sell it in the open market.

Q. Please describe the contract that governs the Brightmark RNG project.

A. The RNGSA between Peoples and Brightmark, a Chevron-backed developer, is a cost-of-service agreement that fully recovers the revenue requirement associated with the company's investment in the project over a 15-year term. Under the contract, Brightmark will construct, and Peoples will purchase, the digester, biogas conditioning equipment, and RNG transportation facilities necessary to collect, condition, transport and inject the RNG from the project and Peoples will charge Brightmark a levelized, cost of service-based rate over the life of the contract. Brightmark is responsible for the operation and maintenance of the digester, biogas collection line and biogas conditioning

equipment. Peoples will retain ownership and be responsible for the O&M expense of the RNG transportation facilities associated with the project during and after the term of the agreement. The agreement includes guarantees and a firm commitment by Brightmark to pay the full revenue requirements of the project.

Q. What is the total capital investment and projected in-service date for the Brightmark RNG project?

A. Including spend from 2021, the total capital investment made by Peoples for the Brightmark project is expected to be approximately $42.7 million. Absent unforeseen circumstances, the project is estimated to be in service during the second quarter of 2023.

Q. Has Peoples proposed a special depreciation rate for the RNG facilities associated with the Brightmark project?

A. Yes. Peoples filed a petition with the Commission on December 15, 2022, seeking approval of a depreciation rate with a 15-year life for use with the Brightmark RNG assets. The petition was assigned Docket No. 20220212-GU and appears to be on a procedural schedule that will run parallel to this case.

Q. Why did the company propose a 15-year life for depreciation of the Brightmark RNG assets?

A. The company proposed using a 15-year life for these assets to match depreciation cost recovery with the company's revenue stream under the contract, and so the net book value of the Brightmark RNG assets will be zero when the contract expires and title to the RNG assets will be transferred to Brightmark. This proposal honors the matching principle for ratemaking and will prevent the company from recording a loss on the disposition of the assets or having a depreciation reserve deficiency at the end of the term of the agreement. Company witness Dane A. Watson discusses the proposed depreciation rate for the Brightmark RNG assets further in his prepared direct testimony.

Q. Is the company's investment in the Brightmark RNG project prudent?

A. Yes. The company's Brightmark RNG project is prudent. The company's involvement in the project meets a specific customer need and the revenue requirement associated with the project will be recovered over the life of the contract via monthly service charge payments for the Brightmark RNG assets and related RNG transportation facilities. Although the RNG

generated by the project will not be owned by Peoples or provided by Peoples to its customers, the Brightmark project will generate the environmental, resiliency, and other RNG benefits previously described in my testimony.

ALLIANCE DAIRIES RNG PROJECT

Q. Please describe the Alliance Dairies RNG project.

A. As part of the Alliance Dairies RNG project, Peoples has constructed and will own the RNG conditioning, and transportation facilities required to transport RNG produced at the Alliance Dairies Farm into the FGT interstate pipeline system. The RNG produced by the project will be tested by Peoples to ensure the gas specifications meet the requirements of FGT's interstate pipeline system before injection into the pipeline system. Peoples expects the peak daily amount of RNG to be transported through our system from the Alliance Dairies Farm to be equivalent to the daily natural gas demand of about 6,000 residential customers.

Q. Who will own the RNG facilities associated with the project?

A. Alliance Dairies will own the digester and all facilities on the farm side of the digester. Peoples will own the RNG conditioning, and transportation facilities on the pipeline

side of the digester and has included that investment in its proposed rate base for the 2024 test year. However, as mentioned above, Peoples will recover its capital investment through a revenue sharing arrangement with the farmer that monetizes the environmental attributes of the project.

Q. Who will own the RNG created by the project?

A. Peoples will own the RNG arising from the project and will market the environmental attributes associated with the RNG through a relationship the company has with an environmental attribute broker. The environmental attributes associated with the Alliance Dairies RNG project will essentially be stripped from the "green" RNG and monetized by selling the attributes in an environmental credit market. Peoples will own the resulting "brown gas" for use by its customers.

Q. What does the company propose to do with the brown gas arising from the Alliance Dairies RNG project?

A. The company proposes that the brown gas remaining after the environmental attributes are monetized, be provided to Peoples' gas supply customers through the Purchased Gas Adjustment Cost Recovery Clause ("PGA") at a zero-commodity price resulting in immediate savings to all gas supply

customers.

Q. What impact will the Alliance Dairies RNG project have on the company's revenue requirement for the 2024 test year?

A. Even though the investments and expenses of the Alliance Dairies RNG project will be included "above-the-line" for ratemaking in the 2024 test year, the value of environmental attributes expected from the project will support the overall revenue requirement of the project in the 2024 test year and beyond. Peoples' witness Parsons will explain this further in her prepared direct testimony.

Q. Please describe the contract that governs the Alliance Dairies RNG project and the structure of payments to Alliance Dairies.

A. Peoples has entered into a Biogas Incentives agreement with Alliance Dairies under which Peoples will own the RNG generated by the project as well as the environmental attributes associated with the Alliance Dairies RNG project. Peoples will make monthly payments to Alliance Dairies based on the monetized value of the environmental attributes associated with the RNG.

The agreement was structured so that revenues from the sale of the environmental attributes associated with the RNG created by the project will be Peoples' primary source of cost recovery for its capital investment in the project. The payments by Peoples to Alliance Dairies were structured to ensure Peoples retains a greater percentage of project revenues until the company's project costs are fully recovered. Based on current projections, Peoples expects to recover the full cost of its investment in RNG facilities for the Alliance Dairies RNG project by 2030. The parties adopted this approach to accelerate cost recovery for Peoples and to mitigate any financial risks the project may have on the company's general body of ratepayers.

Q. What is the total capital investment and projected in-service date for the Alliance Dairies RNG project?

A. The total capital investment made by Peoples for the Alliance Dairies RNG project is approximately $11.0 million, which includes spending in 2021. Absent unforeseen circumstances, the company expects the Alliance Dairies RNG project to be in service by the end of the second quarter of 2023.

Q. Does the Alliance Dairies RNG project benefit the company's customers?

A. Yes. The project is prudent and benefits the company's customers in several ways.

First, as previously mentioned, Peoples proposes that the brown gas remaining after the environmental attributes of the RNG generated by the project have been sold will be provided to Peoples' customers through the PGA at a zero-commodity price. Since the cost of the Alliance Dairies RNG facilities owned by Peoples will be recovered via revenue from the sale of environmental attributes, Peoples' customers will essentially receive the brown gas from the project for free. The company expects the annual commodity value of the Alliance Dairies brown gas to be approximately $396,000 every year assuming the market value of traditional natural gas is $3.00/MMBtu.

Second, the projected revenue stream from the sale of the environmental attributes will support the revenue requirement for the project in the 2024 test year and beyond. This is forecasted to be true even though the investments and expenses of the Alliance Dairies RNG project will be included "above the line" for ratemaking in the 2024 test year.

Third, the project will allow the company's customers to participate in an RNG project that will deliver sustainable,

carbon-negative, pipeline-quality gas produced and distributed in Florida, that can be used in homes and businesses.

Fourth, because the RNG from Alliance Dairies will be produced in Florida, it can be delivered to customers in Florida without paying the interstate transportation charges needed to deliver traditional natural gas purchased out of state into Florida. If the company had to purchase interstate transportation capacity to deliver an equivalent amount of traditional natural gas from out-of-state to Peoples' system, the annual cost would be approximately $93,000, which represents an avoided cost benefit to Peoples' customers.

Fifth, the company's customers will benefit because Peoples' involvement in the project will provide the company with valuable experience operating an RNG facility for the purposes of potentially offering add-on renewable products to all customers in the future.

Q. How does the Alliance Dairies RNG project mitigate risks to the company's general body of ratepayers?

A. Whenever the company builds facilities to serve new Large Customers or greater demand from an existing Large Customer,

it faces a risk that the customer will go out of business before the company gets full cost recovery of its investment to serve the customer. The significance of this risk is a function of numerous factors, including general business conditions, market forces impacting the specific industry in which the customer operates, and the long lives used to calculate depreciation rates for public gas utilities like Peoples.

The risks associated with the Alliance Dairies RNG project are modest and have been mitigated by the design of the transaction.

First, the company's total investment in the project is approximately $11.0 million, which is modest by utility project standards.

Second, the company is not constructing or owning the digester, which is one of the more expensive components of the project.

Third, the company has performed due diligence on Alliance Dairies and has found it to be one of the most professionally operated dairies in Florida, and if the growing base of Florida consumers continue to drink milk, the risk of major

market changes that would put the dairy out of business seems remote.

Fourth, the revenue payments under the contract have been designed in favor of Peoples in the early years of the contract to promote full cost recovery by Peoples in approximately seven years, which is a short period by traditional utility standards.

TEST YEAR OPERATIONS AND MAINTENANCE EXPENSES

Q. What amount of Gas Supply and Development O&M expense was incurred in 2022?

A. The total O&M expenses attributable to base rates in 2022 was $2.6 million. This total amount is primarily reflected in the amounts for FERC Accounts 920 and 921 shown on MFR schedule G-2, page 17.

Q. What are the projected O&M expenses for your area in 2023 and 2024?

A. The totals in 2023 and 2024 are $2.8 million and $3.6 million, respectively. The distribution of these amounts is primarily within the amounts for FERC Accounts 920 and 921 shown on MFR schedule G-2, page 17.

Q. Why is the total projected amount of 2024 O&M expenses for your area higher than the actual amount in 2022?

A. The total in 2024 is $1.0 million higher than in 2022. Approximately $600,000 of this increase is labor costs that were budgeted on a trended basis as described by company witness Donna L. Bluestone in her direct testimony. The remainder of the increase is not trended labor costs.

Q. Why are not trended labor costs increasing from 2022 to 2024?

A. Most of the O&M expenses incurred in the Gas Supply and Development area are labor related, so our O&M expense levels have been influenced by the need to add personnel to meet Florida's significant growth, and by upward market pressures on labor and wage rates.

The company has expanded Gas Supply and Development's responsibilities to include: (1) enhancing the trading and transportation group to manage our system of gas supply and transportation; (2) meet increased gas demand across multiple gas markets, including new pipeline development to serve end users in RNG, industrials and LNG; and (3) development of a resource planning team to provide forecasting and analytical support to expand our system efficiently and effectively.

Q. Why does the company need to add personnel in the Gas Supply and Development Area?

A. Peoples intends to add new Gas Supply and Development positions in the next couple years, equivalent to six replacement positions in 2023 and two replacement positions and three new positions in 2024, exclusive of any allocations. These positions are listed on MFR G-2, page 19e and are needed so the Gas Supply and Development team can perform its enhanced responsibilities described above, and to help the company respond to the growth of Florida and changing market conditions and customer expectations. Finding qualified persons to fill these positions has been a challenge in the current labor market but Peoples has been pleased with our ability to hire talented people so far. The challenges of the current labor market are explained in witness Bluestone's direct testimony and have been experienced in the Gas Supply and Development area.

Q. Why is the level of Gas Supply and Development O&M expenses in the 2024 test year reasonable?

A. The projected O&M expenses are based on current market costs with reasonable inflationary adjustments and represent best estimates of anticipated O&M expenses in 2024. The additional

team members to be hired in 2023 and 2024 are needed so the Gas Supply and Development team can continue to support Peoples' efforts to provide safe and reliable gas system to its growing customer base.

MINIMUM VOLUME COMMITMENT GAS TRANSPORTATION AGREEMENT

Q. What new form of agreement is Peoples proposing to add it its tariff?

A. As discussed in company witness Karen L. Bramley's direct testimony, Peoples is proposing to add a new minimum volume commitment gas transportation form agreement to ensure that certain industrial and large commercial customers requesting gas transportation service that need construction of new mains and/or additional facilities are bound by contract to use and pay for the transportation service requested. The proposed changes will protect the general body of ratepayers and should be approved.

SUMMARY

Q. Please summarize your prepared direct testimony.

A. Peoples' customers have the choice to use natural gas or other alternatives for their energy needs. Our focus on meeting customer expectations and understanding their daily

operational and future needs through regular interactions has placed us in a position to be the preferred choice for providing affordable and reliable energy. As a result, Large Customers are increasing seeking natural gas as an environmentally beneficial option for power generation, transportation and other direct end-uses. Further, Peoples' Gas Supply and Development activities and costs are reasonable and appropriately position Peoples to meet future Large Customer demand while prudently managing its costs. Peoples is committed to providing safe and reliable service and have reinforced our ability to mitigate the effect of peak pricing on our customers during volatile energy market events, evidenced by the outcome of a significant supply disruption event, Storm Uri in 2021. Our system integrity was maintained throughout the event and did not result in a single service interruption to our customers.

Peoples is proud of the work the company is doing to support the development of Florida's economy by making low-cost and clean natural gas accessible to more customers as well as supporting the development of sustainable energy solutions including CNG, LNG, and RNG.

Q. Does this conclude your prepared direct testimony?

A. Yes.

EXHIBIT

OF

LEW RUTKIN, JR.

PEOPLES GAS SYSTEM, INC.
DOCKET NO. 20230023-GU
WITNESS: RUTKIN

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PEOPLES GAS SYSTEM, INC.
DOCKET NO. 20230033-GU
EXHIBIT NO. LR-1
WITNESS: RUTKIN
DOCUMENT NO. 1
PAGE 1 OF 1
FILED: 04/04/2023

List of Minimum Filing Requirements

Sponsored or Co-Sponsored by Lew Rutkin, Jr.

MFR Schedule	Page No.	MFR Title
C-3	P. 1	Operating Revenues By Month
C-38	P. 4	O & M Benchmark Variance By Function
G-1	P. 23	Historic Base Year + 1 - Construction Budget
G-2	P. 6 (a-f)	Historic Base Year + 1 – Revenues And Cost Of Gas
G-2	P. 8 (a-f)	Projected Test Year - Revenues And Cost Of Gas
G-2	P. 17	Projected Test Year - Calculation Of Admin. And General Expenses
G-2	P. 19a	Projected Test Year - Total Expenses
G-2	P. 19e	Projected Test Year - Total Expenses
G-6	P. 1-9	Projected Test Year - Major Assumptions

Benefits of RNG: Improved Waste Management, Climate Change Mitigation, and a More Environmentally Responsible and Sustainable Circular Economy

The environmental and economic benefits of producing and using renewable natural gas (RNG) span a variety of interrelated categories—including improved waste management, energy decarbonization, GHG mitigation, investment and job creation, energy resilience, improved air and water quality, and the creation of useful byproducts—that combine to promote a circular economy.

- **Improved Waste Management** - Investments in RNG are investments in better waste management practices, including collection and digestion of inedible food waste and manure.

- **GHG Mitigation** – Naturally occurring methane (CH_4) and carbon dioxide (CO_2) emissions from energy and anthropogenic waste are two of the largest sector contributors to climate change in the U.S.[1] RNG has a unique role to play because of its ability to simultaneously reduce greenhouse gas (GHG) emissions from both sectors.

- **Energy Decarbonization** - Because RNG can be deployed to produce electricity, displace conventional natural gas or produce hydrogen, displacing fossil fuels with RNG allows for decarbonization across multiple parts of the energy system,while supporting greater consumer choice today and in the future.

- **Local Investment** - RNG projects attract millions of dollars in capital investment, and provide direct funding, revenue generation, and cost savings to farmers and local governments.

- **Job Creation** - RNG creates domestic, clean energy sector jobs in construction, operations, maintenence, manufacturing and engineering, especially for people with previous experience in energy-focused industries.

- **Energy Resilience** - RNG provides reliable, sustainable, and dispatchable energy when there is a power outage, as exemplified through its use in microgrids[2] to support essential services for food storage, airports, universities, hospitals, and other mission critical facilities.

- **Improved Air Quality** - RNG mitigates the nitrogen oxides (NOx) and particulate matter (PM) that cause smog, offering significant air quality improvements compared to fossil fuel energy alternatives.[3,4]

- **Improved Water Quality** - RNG projects control nitrogen, phosphorus, and pathogens associated with waste, preventing runoff and contamination of water resources.

- **Useful Products** – Producing RNG creates valuable agricultural inputs from waste, helping to grow a more environmentally responsible and sustainable circular economy.

[1] U.S. EPA, "Greenhouse Gas Emissions - Overview of Greenhouse Gases."
[2] Microgrid Knowledge, "How RNG and big energy consumers are changing the microgrid proposition."
[3] US EPA, "Renewable Natural Gas."
[4] Advanced Clean Tech News, "RNG is the Fast Track to Cleaner Air in California."

RNG Promotes Improved Waste Management

Waste is an inevitable by-product of human activity. Decomposing organic wastes naturally release a methane-laden "biogas"; capturing that biogas to to make clean-burning, high-value RNG incentivizes a more thorough and holistic management of organic waste.

- World Bank projects the total volume of solid waste to grow 69% by 2050.[5]
- Total feedstocks available for sustainable RNG production are projected to grow 40% by 2040 according to the International Energy Agency.[6]
- A significant portion of the biogas produced by decomposting organic wastes—and the methane it contains—will vent into the atmosphere unless it is collected and destroyed by:
  - Combustion at a flare, which has no productive benefit, or
  - Consumption of RNG, when deployed as a productive energy product, like fuel, heat, electricity, hydrogen, or a clean-chemical feedstock.[7]

Investments in RNG are investments in better waste management practices, including collection and digestion of inedible food waste and manure to produce energy.

RNG Helps Mitigate GHG Emissions

By producing RNG from food waste, municipal solid waste, wastewater, and manure, naturally occurring methane emissions are captured, converted into renewable energy, and destroyed in productive consumption.

- CO_2 emissions from energy production and methane emissions from anthropogenic waste are two of the largest sector contributors to climate change in the U.S.[8] Reduction of GHG emissions from both sectors at once makes RNG a unique, multi-benefit energy resource.
- Life Cycle Accounting (LCA) measures all emissions from the production, transportation, distribution and consumption of a fuel. Depending on the waste it's produced from, the Carbon Intensity (CI) of RNG ranges from a 50%+ reduction compared to diesel fuel or conventional natural gas to significantly carbon-negative (producing the fuel prevents more emissions than come from using it).[9] RNG represents a significant GHG benefit compared to conventional fuels.
- RNG is composed of biogenic carbon. This means that any carbon emissions released from the end use of RNG are already part of a sustainable natural cycle.[10]
- **Under current GHG reporting protocols, CO_2 emissions from RNG are treated as *carbon neutral*.**[11] Corporate RNG consumers achieve 100% reduction in Scope 1 CO_2 emissions.
  - RNG with a CI score better than zero (carbon negative) due to upstream methane reductions can achieve additional GHG benefits outside of Scope 1

[5] Kaza et al. (2018). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050.
[6] IEA. (2020, March). Outlook for Biogas and Biomethane.
[7] Myhre et al. (2013). Anthropogenic and Natural Radiative Forcing in Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.
[8] U.S. EPA, "Greenhouse Gas Emissions – Overview of Greenhouse Gases."
[9] Argonne National Laboratory, "Renewable Natural Gas for Transportation," 2021.
[10] UC Davis. (2020, August 6). Science & Climate Definitions – Biogenic Carbon.
[11] WRI. (2004, March). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.

RNG is an Important Part of Energy Decarbonization

Because RNG can be deployed as natural gas, or to produce electricity or hydrogen, its use in place of fossil fuels allows for multi-sector energy system decarbonization while supporting greater consumer energy choices *today,* and in the future as the sustainability economy evolves.

- RNG is a true "drop-in" fuel that requires no changes to existing appliances, including cooktops, furnaces, boilers, natural gas vehicles, or high-heat industrial equipment.
- RNG supports intermittent renewable electricity sources like wind and solar, because it is storable and can be used in dispatchable power generation resources. Scenario modeling by jurisdictions leading the push to electrification shows significant gas demand through 2050,[12] illustrating a clear long-term need for RNG in a wide variety of end uses.
- Renewable gases are a long-term necessity in industrial heating applications, where decarbonization through electrification is unlikely to be technically feasible due to temperature requirements.[13]
    - In many cases, even where alternatives do exist, renewable gases are the most cost-effective decarbonization option on a $/ton of GHG reduced basis.[14]
- The United States could produce as much as 1,425.3 tBtu/yr of RNG by 2040, which is enough RNG to supply *all* current commercial gas demand nationwide, or 75% of current residential demand, or 45% of industrial demand.[15]

RNG Brings Investment to Local Economies

The RNG industry has experienced unprecedented growth in recent years, adding nearly 100 new RNG facilities across North America since 2011.

- As of August 2022, there were 276 operating RNG facilities in North America and over 100 additional RNG facilities in development and under construction.[16]
- Every new RNG project brings millions of dollars in capital investment to local economies.[17]
    - Municipalities can realize hundreds of thousands (if not millions) of dollars in revenue, and shift risk and operating costs to a third party, through public-private partnerships to convert local waste streams to RNG.[18]
- On-farm and municipal digesters can process organic waste from external sources, creating revenue streams not only from the sale of RNG produced from their waste, but also from the service they provide to others.[19]

RNG Creates Jobs

RNG creates domestic, clean energy sector jobs in construction, operations, maintenance, manufacturing and engineering.

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[12] CEC. (2020, April). The Challenge of Retail Gas in California's Low Carbon Future.
[13] Bataille et al. (2018, June 20). A Review of Technology and Policy Deep Decarbonization Pathway Options for Making Energy-Intensive Industry Production Consistent with the Paris Agreement.
[14] Ibid.
[11] American Gas Foundation. (2019, December). Renewable Sources of Natural Gas: Supply and Emissions Reduction Assessment, pg. 14.
[16] RNG Coalition, RNG Production Facilities in North America.
[17] ICF. (2017, May). Economic Impacts of Deploying Low NOx Trucks fueled by Renewable Natural Gas.
[18] Ameresco. (2019, December). Making Your Organization Carbon Neutral with Renewable Natural Gas.
[19] U.S. EPA. (2020, August 18). The Benefits of Anaerobic Digestion.

- Each new RNG production facility creates 5-7 times more jobs than an equivalently sized petroleum refinery.[20]
- Every job created by RNG creates two jobs in supporting industries (technology, manufacturing, finance, etc.). [21]
- RNG facilities provide clean energy sector jobs for people with previous experience in the oil, gas, coal, or other engineering or energy-focued industries.

RNG Provides Energy Resilience

RNG and RNG-derived hydrogen serve as reliable, dispatchable sources of sustainable energy through use in baseload generation facilities and/or fuel cells.

- RNG-powered microgrids[22] provide economic benefit as a sustainable localized energy source.
  - This level of reliability holds significant value for food storage, universities, hospitals, and other mission critical facilities where loss of power could have catastrophic impacts

RNG Improves Air Quality

RNG mitigates the nitrogen oxides (NOx) and particulate matter (PM) that cause smog, offering significant air quality improvements compared to fossil fuels.

- Use of RNG in the heavy-duty transportation sector has significant potential to reduce NOx and PM2.5 emissions compared to diesel.[23]
- Current commercially available natural gas engine technology is 90% cleaner than the cleanest diesel engine, and 90% cleaner than EPA's current NOx requirement.[24]

RNG Improves Water Quality

Absent comprehensive management through aggregation and containment processses, many organic waste sources present water quality issues, especially from run-off.

- Anaerobic Digestion is a cost-effective treatment of manure and biosolids used by thousands of facilities across the U.S.[25]
  - Nitrogen and phosphorus are concentrated and controlled during the anaerobic digestion process, decreasing runoff into ground water and other water resources.[26]
  - Anaerobic digestion reduces pathogen levels up to 99% compared to undigested manure.[27]
- Because RNG can be sold into a diversity of energy markets, the addition of RNG upgrading technology to an anaerobic digester helps financially incentivize better waste stream management and the mitigation of air and water quality impacts from waste.

[20] RNG creates 8.5 – 11.2 jobs per million diesel gallon equivalent (DGE); the petroleum refinery industry yields 1.6 jobs per million DGE. ICF, Economic Impacts of Deploying Low NOx Trucks Fueled by Renewable Natural Gas, May 2017.
[21] Ibid.
[22] Microgrid Knowledge, op. cit.
[23] M.J. Bradley & Associates. (2020, February). The Role of Renewable Biofuels in a Low Carbon Economy.
[24] Ibid.
[25] USDA, US EPA, US DOE. (2014, August). Biogas Opportunities Roadmap.
[26] Ibid.
[27] Ibid.

RNG Creates Useful Products from Waste

- RNG production through anaerobic digestion of materials such as food waste, animal manure and wastewater yields valuable by-products.
  - AD converts nutrients contained in organic wastes into a form more accessible by plants than e.g. raw animal manure, allowing for more effective use as fertilizer.[28]
  - After the elimination of pathogens, digested solids can be recycled for use as animal bedding.[29]
- Direct use or sale of AD by-product materials can add an important revenue stream (or create savings) to aid farmers and local governments.
- Recycling and using the by-products of waste through the RNG production processes creates a more environmentally responsible and sustainable circular economy.

[28] U.S. EPA. (2020, August 18). The Benefits of Anaerobic Digestion.
[29] Ibid.


SEA LNG
sgmf
the society for gas as a marine fuel
AIDAnova
AIDAnova
CARDISSA
WELL-TO-WAKE GHG EMISSION STUDY
ON LNG AS A MARINE FUEL

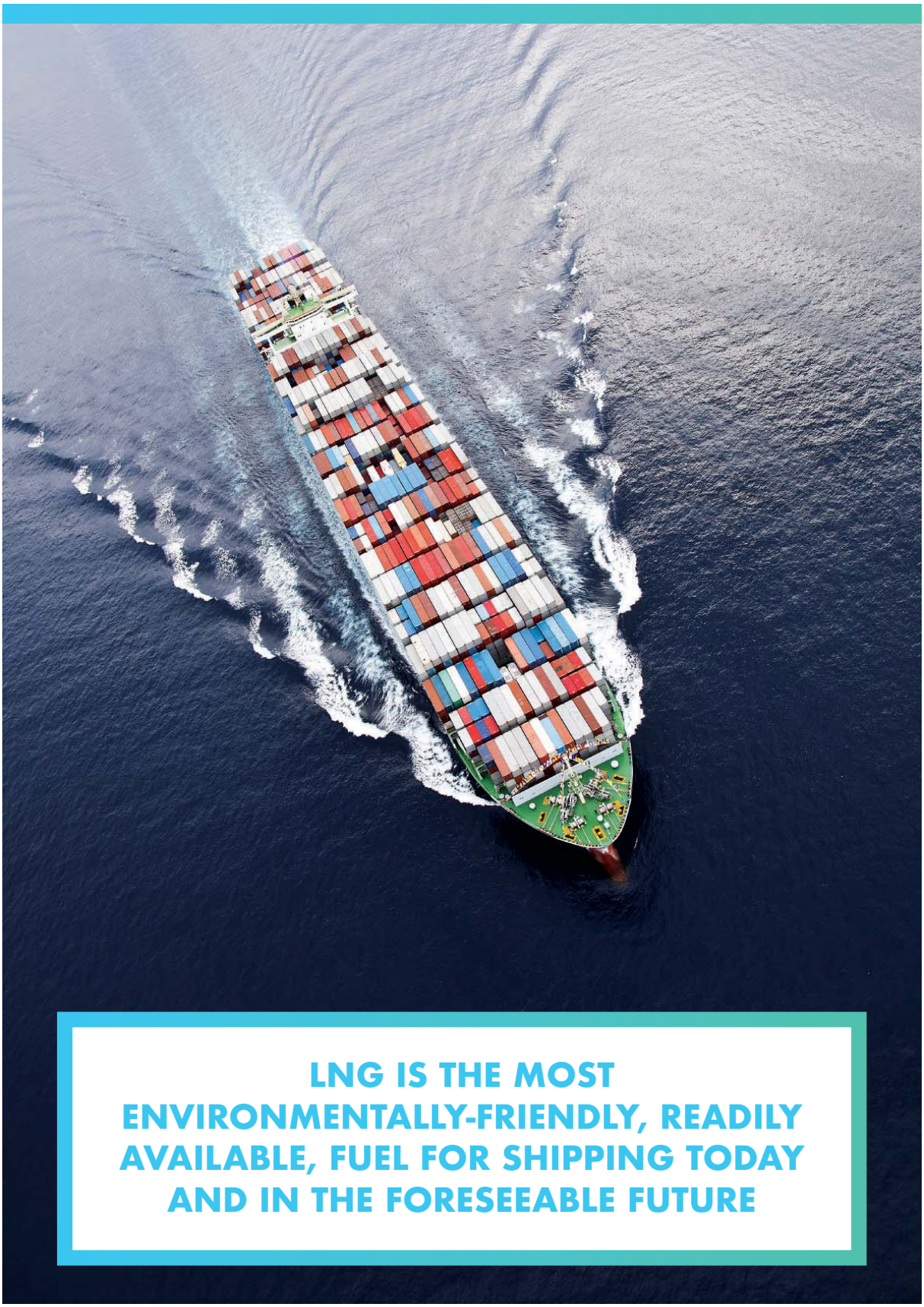
INTRODUCTION

SEA\LNG and SGMF commissioned this Well-to-Wake (WtW) Greenhouse Gas (GHG) Emissions Lifecycle Research Study on the use of LNG as a marine fuel. Conducted by independent specialist consultants thinkstep, and reviewed by a panel of academic experts, it is the most accurate study of the life cycle GHG emissions and local pollutants from LNG as a marine fuel compared with current and post-2020 conventional marine fuels as it is done on a complete WtW basis.

KEY FINDINGS

LNG IS THE MOST ENVIRONMENTALLY-FRIENDLY, READILY AVAILABLE, FUEL FOR SHIPPING TODAY AND IN THE FORESEEABLE FUTURE

- The use of **LNG** as marine fuel shows **GHG benefits of up to 21% compared with current oil-based** marine fuels over the entire life cycle from WtW
  - On an engine technology basis today, the absolute WtW emissions reduction benefits for gas fuelled engines compared with Heavy Fuel Oil (HFO) fuelled ships are between 14% to 21% for 2-stroke slow speed engines, and between 7% to 15% for 4-stroke medium speed engines.
  - These GHG emission reduction benefits for gas fuelled engines do not change significantly when compared with the expected post-2020 compliant oil-based marine fuel options.
- On a **Tank-to-Wake (TtW) basis**, the combustion process for **LNG** as a marine fuel shows **GHG benefits of up to 28%** compared with current oil-based marine fuels.
  - On an engine technology basis, the TtW emissions reduction benefits for gas fuelled engines compared to HFO fuelled ships are between 18% - 28% for 2-stroke slow speed engines and between 12% - 22% for 4-stroke medium speed engines.
- **LNG** provides a **significant advantage in terms of improving air quality** when compared to other conventional fuels which is **particularly important in ports and coastal areas**
  - Due to the negligible amount of sulphur in the LNG fuel, sulphur oxides (SOx) emissions are reduced close to zero
  - Other local pollutants, such as nitrogen oxides (NOx) and particulate matter (PM), are reduced significantly when using LNG compared with current conventional marine fuels.
    - NOx emissions can be reduced by up to 95 % to meet the International Maritime Organization (IMO) Tier III limits without NOx reduction technologies when using Otto-cycle engines.
    - PM emissions of up to 99 % are possible compared with HFO


LNG IS THE MOST ENVIRONMENTALLY-FRIENDLY, READILY AVAILABLE, FUEL FOR SHIPPING TODAY AND IN THE FORESEEABLE FUTURE

THIS STUDY REVIEWED THE CURRENT STATE-OF-THE-ART TECHNOLOGY AND CONSIDERED THE FUTURE AND THE POTENTIAL FOR FURTHER IMPROVEMENTS

- LNG is a fully compliant **viable solution** now and significantly **reduces GHG emissions** from international shipping, thereby **contributing to the IMO GHG reduction targets**
- Ongoing **optimisation** in **supply chain and engine technology developments** will **further enhance the benefits of LNG** as a marine fuel
  - We can expect to see continual improvements in engine design and the introduction of solutions such as methane oxidation catalysts that will reduce methane slip
  - Ongoing improvements in energy efficiency, combined with other measures such as enhanced operational methods and speed optimisation, will make further major contributions to emissions reductions
- **BioLNG** and **Synthetic LNG** also offer the **potential for significant GHG emissions reductions**
  - Analysis showed that bioLNG and synthetic LNG provide a significant additional benefit in terms of WtW GHG intensity. Bio and synthetic LNG are fully interchangeable with LNG derived from fossil feedstock. For example, a blend of 20% bioLNG as a drop-in fuel can reduce GHG emissions by a further 13% compared with 100% fossil fuel LNG.

THIS REPORT IS THE DEFINITIVE STUDY INTO GHG EMISSIONS FROM CURRENT MARINE ENGINES

- It is **COMPREHENSIVE** - using the latest primary data to assess all major types of marine engines and global sources of supply
  - 2-stroke slow speed (most common and largest deep-sea sector these ships account for 72% of the global marine fuel market)
  - 4-stroke medium speed (28% of fuel usage mainly for short sea shipping and cruise)
  - 4-stroke high speed (5% of fuel usage)
  - Others – (5% of fuel usage)
- It is **QUALITY ASSURED** - assesses the supply and use of LNG as a marine fuel according to ISO standards
- It is **OBJECTIVE** - peer-reviewed by leading academics from key institutions in France, Germany, Japan and the USA

LNG PROVIDES A MAJOR ADVANTAGE IN TERMS OF IMPROVING AIR QUALITY AND HUMAN HEALTH, WHICH IS PARTICULARLY IMPORTANT IN PORTS AND COASTAL AREAS

BACKGROUND

The combined SEA\LNG-SGMF project oversight team was led by SEA\LNG and SGMF, and was fully supported by senior technical personnel from SEA\LNG and SGMF member companies. The following Original Equipment Manufacturers provided data for the study to thinkstep: including Caterpillar MaK, Caterpillar Solar Turbines, GE, MAN Energy Solutions, Rolls Royce (MTU), Wärtsilä, and Winterthur Gas & Diesel, as well as from ExxonMobil, Shell, and Total from the supply side. The extensive industry experience and practical knowledge over the project oversight team ensured all the data used was the latest and best available.

thinkstep is a leading global consulting and software company in the field of sustainability, especially life cycle thinking. thinkstep has grown considerably over the last 25 years. It has used the knowledge gained and the work performed for 2,500 clients worldwide, including some of the world's most respected brands, to continuously improve its skills and abilities. This has led to new strategies, management systems, tools and processes needed to achieve leadership in sustainability.

The study has been reviewed by a panel of academic experts according to ISO 14044, section 6. The members of the critical review panel were:

- **Philippe Osset**, Solinnen, Paris (France) - CEO, member of the ISO 14040/14044 working group - chair of the review panel
- **Prof Dr Atsushi Inaba**, Kogakuin University (Japan) - Department of Environmental and Energy Chemistry - reviewer
- **Prof Dr Friedrich Wirz**, Technical University of Hamburg (Germany) - Head of Working Group Marine Engineering - reviewer
- **Dr Michael Wang**, Argonne National Laboratory (USA) - Group Manager Systems' Assessment Group, Energy System Division - reviewer

PEER REVIEWED BY LEADING ACADEMICS


LNG IS SAFE TO USE, FULLY COMPLIANT,
AND READILY AVAILABLE AS A
MARINE TRANSPORT FUEL

LNG FUNDAMENTALS

LNG OFFERS A SAFE, MATURE, COMMERCIALLY VIABLE, LONG-TERM PATHWAY TOWARDS A ZERO-EMISSIONS SHIPPING INDUSTRY

- LNG provides a **major advantage** in terms of improving **air quality and human health**, which is **particularly important in ports and coastal areas**
- LNG is **SAFE** to use, fully compliant, and readily available as a marine transport fuel
- LNG is **clean** and **poses no pollution risk to ocean environments** and has **no waste disposal or discharge issues**
    - As methane, the main constituent of natural gas, is lighter than air and boils at minus 161.5 degree centigrade, any leakage of liquified natural gas into an ocean environment will quickly evaporate making LNG a risk-free fuel for pristine and sensitive marine environments.
- **LNG** as a marine fuel **in combination with efficiency measures** being developed for new ships in response to the IMO's Energy Efficiency Design Index (EEDI), **will provide a way of meeting** the **IMO's** decarbonisation target of a **40% decrease by 2030** for international shipping
- **Longer term further GHG gas reductions** could be **realised through** the use of **bioLNG** (from biogas) as a 'drop-in' fuel, significantly reducing GHG emissions.
- **'Power-to-gas'** is a **key technology** with the potential to **produce** large volumes of **renewable LNG**
- Standards, Guidelines and Operational Protocols are all in place to ensure that the **SAFE WAY** is the **ONLY WAY** when using gas as ship fuel
- LNG **meets and exceeds all current and 2020 marine fuel compliance requirements** for content and emissions, local and GHG
- With the world **LNG Bunker Vessel fleet doubling in the next 18 months** and those vessels being deployed at major bunkering hubs, **LNG availability as a ship fuel is increasing rapidly**

SEA LNG sgmf the society for gas as a marine fuel thinkstep

READ THE STUDY

Offsets and RECs: What's the Difference?

Introduction

In encouraging organizations to choose green power for their electricity, the Green Power Partnership frequently explains renewable energy certificates (RECs)—what they are, why they are needed for green power, and how they are used. Many Green Power Partners and Partnership stakeholders were familiar, at least conceptually, with offsets before learning about green power and RECs. It is common for RECs to be compared with offsets, thought of as a type of offset, or described as "offsetting" emissions. Offsets and RECs, however, are fundamentally different instruments.

Organizations working to lower their emissions footprint have a variety of mitigation options at their disposal, including activities to reduce their direct emissions, activities to reduce indirect emissions like energy efficiency measures and switching to green power, and paying for external reductions. Knowing the differences between instruments like RECs and offsets is critical to deciding how both may be useful to your organization.

What is a REC?

A renewable energy certificate – REC (pronounced: rĕk) is a tradeable, market-based instrument that represents the legal property rights to the "renewable-ness"—or non-power (i.e., environmental) attributes—of renewable electricity generation.

A REC is created for every megawatt-hour (MWh) of electricity generated and delivered to the grid from a renewable energy resource.

Electricity cannot be considered renewable without a REC to substantiate its renewable-ness.

This document explains what these two widely used instruments are, the differences between them, why and how an organization might use one or both, and common misconceptions.

To begin, this tables summarizes some of the basic differences between offsets and RECs.

Basic Differences	Offsets	RECs
Unit of Measure	Metric tons of CO_2 or CO_2 Equivalent	Megawatt hours (MWh)
Source	Projects that avoid or reduce greenhouse gas (GHG emissions to the atmosphere	Renewable electricity generators
Purpose	Represent GHG emissions reductions; provide support for emissions reduction activities; and lower costs of GHG emissions mitigation	Convey use of renewable electricity generation; underlie renewable electricity use claims; expand consumers' electricity service choices; and support renewable electricity development
Corporate GHG Inventories and Reporting	Reduce or "offset" an organization's scope 1, 2 or 3 emissions, as a net adjustment	Can lower an organization's gross market-based scope 2 emissions from purchased electricity
Consumer Environmental Claims	Can claim to have reduced or avoided GHG emissions outside their organization's operations	Can claim to use renewable electricity from a low or zero emissions source

Basic Differences	Offsets	RECs
Additionality Test Requirements	Required. Each project is tested for additionality to ensure that it is beyond business as usual. Tests include legal/regulatory, financial, barriers, common practice and performance tests. The combination of tests that is best suited to demonstrate additionality depends on the type of project.	Not required. Project additionality is not required for a renewable energy usage claim or to report use of zero-emissions power.

Many organizations start managing their footprint by developing a GHG emissions inventory. Under the WRI/WBCSD GHG Protocol[1], an organization follows a standard set of accounting guidelines to measure emissions and develop an emissions inventory that separately accounts for the emissions they are responsible for from their operations, energy purchases and supply chain in three different ledgers, known as scopes 1, 2, and 3.

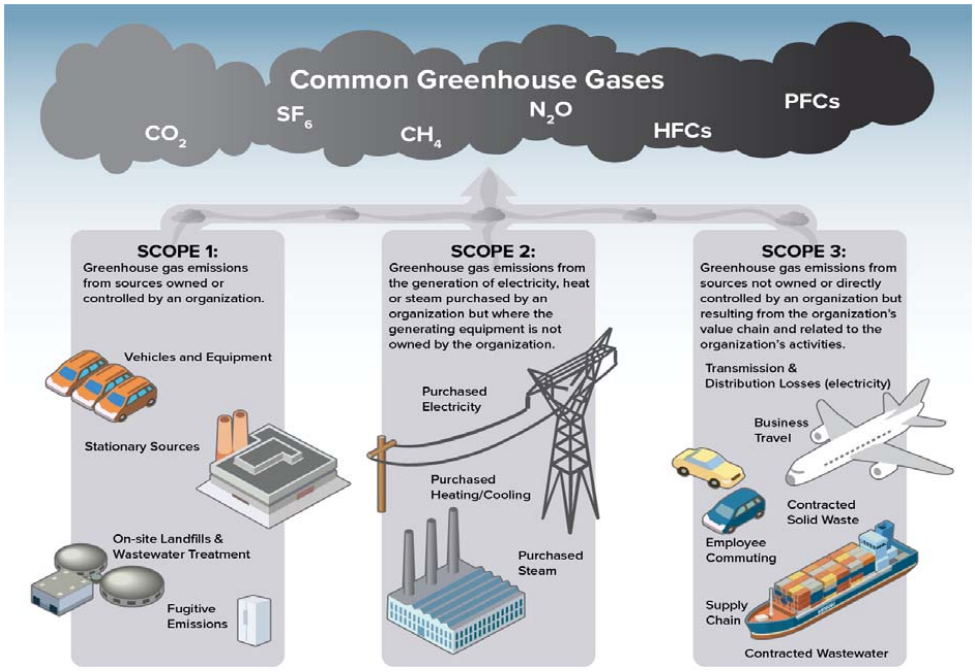


Figure 1. Common Sources of Emissions by Scope

The scopes help distinguish emissions from sources that the organization directly owns or controls (direct emissions) from emissions that are a consequence of the activities of the organization but occur at sources owned or controlled by another organization (indirect emissions). This separate accounting is to ensure that two or more organizations will not account for emissions in the same scope.[2] Through this framework, organizations can assess their performance and determine what mitigation options to pursue.

[1] http://www.ghgprotocol.org/
[2] http://www.ghgprotocol.org/corporate-standard, page 25

As mentioned above, those mitigation options can include the procurement of instruments, and the common instruments in the U.S. are:

- **Offsets** – used to address direct and indirect GHG emissions by verifying global emissions reductions at additional, external projects. Offsets (verified emissions reductions) are subtracted from organizational emissions to determine net organizational emissions.
- **RECs** – used to address indirect GHG emissions associated with purchased electricity (scope 2 emissions) by verifying use of zero- or low-emissions renewable source of electricity. RECs (MWh of renewable energy) are used in the calculations of gross, market-based scope 2 emissions based on the emissions factor of the renewable generation conveyed with the REC.

What is an Offset?

An offset project is "a specific activity or set of activities intended to reduce GHG emissions, increase the storage of carbon, or enhance GHG removals from the atmosphere."[3] The project must be deemed additional[4]; the resulting emissions reductions must be real, permanent, and verified; and credits (i.e, offsets) issued for verified emissions reudctions must be enforceable. The offset may be used to address direct and indirect emissions associated with an organization's operations (e.g., emissions from a boiler used to heat your organization's office building). The reduction in GHG emissions from one place can be used to "offset" the emissions taking place somewhere else. Offsets can be purchased by an organization to address its scope 1, 2, and 3 emissions. Offsets can be used in addition to an organization taking actions within its own operational boundary to lower emissions. Offsets are often used for meeting voluntary commitments to lower GHG emissions where it is not feasible to lower an organization's direct or indirect emissions.[5]

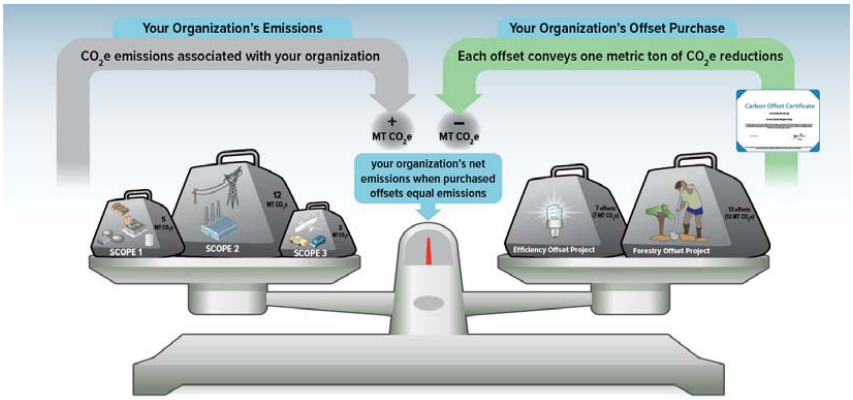


Figure 2. Offsets

An organization's emissions from scopes 1, 2, and 3 are balanced by purchasing offsets equal to the sum of the organization's emissions.

[3] http://www.ghgprotocol.org/standards/project-protocol, page 11, see "GHG Project"
[4] http://www.ghgprotocol.org/standards/project-protocol, page 15, see "2.14 Additionality"
[5] http://www.wri.org/publication/bottom-line-offsets

Why do Organizations Purchase Offsets?

For an organization with a voluntary commitment to reducing its emissions footprint, purchasing and retiring (that is, not re-selling) offsets can be a useful component of an overall voluntary emissions reduction strategy, alongside activities to lower the organization's direct and indirect emissions have been realized.[6]

What is a REC?

Renewable Energy Certificates (RECs) are the legal instruments used in renewable electricity markets to account for renewable electricity and its attributes whether that renewable electricity is installed on the organization's facility or purchased from elsewhere. The owner of a REC has exclusive rights to the attributes of one megawatt-hour (MWh) of renewable electricity and may make unique claims associated with renewable electricity that generated the REC (e.g., using or being supplied with a MWh of renewable electricity, reducing the emissions footprint associated with electricity use). Claims to the attributes of the electricity from a REC can only be made by one party. The purchase or use of renewable energy, verified with RECs, is a decision an organization makes to ensure its electricity is provided from renewable sources that produce low- or zero-emissions, thereby reducing the organization's market-based scope 2 emissions.[7] As the physical electricity we receive through the utility grid says nothing of its origin or how it was generated, RECs play an essential role in accounting and assigning ownership to the attributes of renewable electricity generation and use. RECs legally convey the attributes of renewable electricity generation, including the emissions profile of that generation, to their owner and serve as the basis for a renewable electricity consumption claim. As such, the REC owner has exclusive rights to characterize the quantity of their purchased electricity associated with the RECs as zero-emissions electricity.

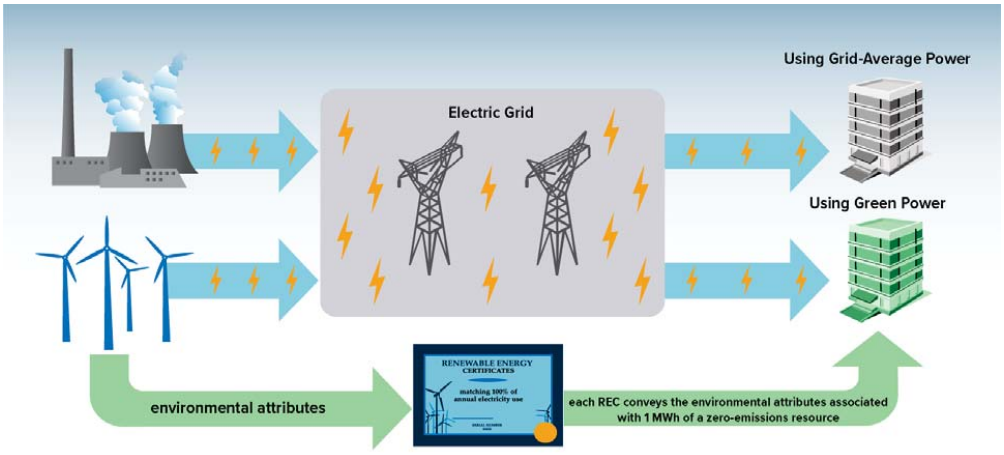


Figure 3. RECs

By purchasing RECs, an organization receives the rights to the environmental attributes of the renewable electricity and may make unique claims (e.g., using X MWh of green power) associated with the renewable electricity that generated the purchased RECs.

[6] http://www.wri.org/sites/default/files/pdf/bottom_line_offsets.pdf

[7] The *GHG Protocol Scope 2 Guidance* defines two methods for scope 2 accounting, the location-based method and the market-based method. The market-based method considers contractual arrangements under which the organization procures power from specific sources, such as renewable electricity.

Why do Organizations Purchase RECs?

RECs can be a flexible tool to help achieve clean energy goals, lower scope 2 emissions associated with purchased electricity, and support the renewable energy market. Though RECs are the essential accounting instrument required for all renewable energy usage claims, regardless of how renewable energy is purchased or consumed, RECs can also be purchased separately from electricity and independently matched with electricity consumption. This can be an attractive option for organizations in regions where renewable energy options, such as utility green pricing /marketing programs are not offered by local suppliers, where policy support for direct engagement in renewable energy projects is lacking, or where these other options are too expensive or not suited to the organizations size or needs. By purchasing RECs and electricity separately, organizations do not need to alter existing power contracts to obtain green power. Additionally, RECs are not limited by geographic boundaries or transmission constraints. For organizations with facilities in multiple states or energy grids, a single, consolidated REC procurement can be part of an organization's strategy to efficiently meet overall clean energy goals.[8]

RECs can be purchased from marketers or sometimes directly from renewable energy generators. Several REC marketers/environmental attribute brokers are active in REC markets, offering another approach to procurement that is increasingly being used by large purchasers. Brokers do not own the certificates but rely on their knowledge of the market to connect buyers and sellers for a fee. Brokers also aggregate and disaggregate supply into customized offerings that meet specific consumer needs. This includes breaking up output from very large projects into smaller bundles as well as aggregating smaller projects offtakes into larger consolidated bundles. They can help negotiate deals that take into account an organization's unique interests. For more information on purchasing RECs, see the Guide to Purchasing Green Power. [9]

Are Offsets and RECs the Same?

No. While both offsets and RECs can help an organization lower its emissions footprint, they are different instruments used for different purposes. Think of offsets and RECs as two tools in your sustainability tool box – like a hammer and a saw. They are not interchangeable. Each tool is used in building a house, but each is used to accomplish specific tasks. One is not more important or better than the other.

Using the term "offset" (even as a verb) when discussing your REC purchases can be confusing in the mind of many listeners – confusing the action of contractually fuel-switching to low- or zero-emissions electricity with having paid for a global emissions reduction. Rather than saying your purchase of RECs is offsetting your emissions, it would be better to claim that your purchase of RECs is renewable electricity from a low- or zero-emissions resource which reduces the emissions associated with your electricity use.

The major differences between these two instruments are:

- **Unit of Measure**: The unit of measure for an offset is typically one metric ton of CO2-equivalent emissions. A REC is based on 1 MWh of renewable electricity.
- **Purpose**: Offsets represent emissions reductions, provide support for emissions reduction activities, and may lower costs of GHG emission mitigation. RECs expand consumers' electricity service choices, convey environmental attributes and renewable electricity use claims, and support renewable electricity development.

[8] http://www.wri.org/sites/default/files/pdf/bottom_line_renewable_energy_certs.pdf
[9] https://www.epa.gov/greenpower/guide-purchasing-green-power

- **Source**: Offsets can come from all different kinds of projects that lower, remove or avoid emissions while RECs are only generated from renewable electricity sources (i.e., solar, wind geothermal, biomass, hydropower).
- **Claims**: A buyer of an offset can claim to have reduced or avoided direct GHG emissions outside their organization's operations. A buyer of a REC can claim to use 1 MWh of renewable electricity from a low- or zero-emissions resource. Purchasers of RECs should avoid confusing statements such as my purchase "offsets" emissions.
- **Accounting Guidance**: Offsets can be used to negate or "offset" an organization's scope 1, 2 or 3 emissions. Offsets are a separate line item intended to define a "net" emissions figure when documenting achievement of a target. RECs allow an organization to lower their market-based scope 2 emissions from purchased electricity.
- **Additionality**: Offsets must represent real, permanent, verified, and enforceable reductions. And most importantly, they must come from activities or project that are additional to what would occur under a business-as-usual scenario. This "additionality" requirement for offset projects is central to ensuring that the ton of emissions reductions you use as an offset is fully equivalent to a ton of emissions reductions from your operations. There is no requirement to demonstrate additionality when applying RECs to an organization's market-based scope 2 emissions. [10]

Summary

Both offsets and RECs represent the environmental benefits of certain actions that can help mitigate GHG emissions. Offsets represent a metric ton of emissions avoided or reduced; RECs represent attributes of 1 MWh renewable electricity generation. Offsets and RECs, however, are fundamentally different instruments with different impacts, representing different criteria for qualification and crediting in the context of inventory or emissions footprint.

[10] http://ghgprotocol.org/scope_2_guidance, page 90. The Project Protocol treatment for additionality does not require a demonstration of additionality for RECs. For more on regulatory additionality/surplus, page 2: https://resource-solutions.org/wp-content/uploads/2016/03/RECs-and-Additionality.pdf.

Case Study:

HART Drives Emissions Down While Saving on Annual Fuel Costs

TECO PEOPLES GAS
AN EMERA COMPANY

Compressed Natural Gas fueling for the transit buses helped.

At The Heart Of Florida's Energy

OVERVIEW:

Hillsborough Area Regional Transit (HART) serves Florida's Hillsborough County with public transportation services. Covering more than 1,000 square miles, HART's fleet includes 200 transit buses. As part of its alternative fuels strategy, the agency is transitioning its buses from diesel to compressed natural gas (CNG).

ENVIRONMENTAL IMPACT

Since 2015, HART's use of CNG has helped improve the region's air quality. Compared to diesel, CNG emits virtually no particulate matter or soot, and less greenhouse gases. Smog forming NOx emissions are now reduced by more than 90%. In addition to the improved air quality, CNG buses are quieter and have helped HART reduce noise pollution throughout the community.

"During Hurricane Irma, we were tasked with evacuating Hillsborough County. With the reliable natural gas pipeline, we never missed a beat."

– Dale Smith
HART Manager of Facilities Maintenance

"The low cost, better environmental benefits, and utmost reliability make CNG a no brainer."

– Timothy O'Conner
Peoples Gas Vice President of Sustainability

ECONOMIC BENEFIT

Natural gas costs less than diesel. Even with the upfront investment needed to purchase new buses and fueling equipment, HART earned a payback on its first buses by the second year. Add to that the annual IRS tax credit for alternative fuel, and the economic benefits are significant.

RELIABILITY AND RESILIENCY

Domestically produced and delivered by underground pipeline, the reliability of natural gas has helped HART reduce unplanned maintenance allowing for more on time routes and predictable operations. And, as a critical transportation provider during emergencies like storm evacuations, CNG supports HART's resiliency plans.

APPROACH

HART began working with Peoples Gas in 2015 to evaluate fuel requirements for its bus fleet. Considering its options, HART developed a business plan for a phased transition of its transit buses to CNG with the conversion of 22 buses in the first phase. By the end of 2020, HART's fleet included 69 buses running on CNG.

- **Fueling Operations Review**
  HART needed fast-fueling to keep buses fueled and ready for route schedules.
- **Fueling Station Design Considerations**
  HART planned to operate and maintain a private fueling station on property that would be dedicated to its fleet.
- **Capital Investment Structure**
  Without significant capital constraints, HART could own a dedicated station.
- **Natural Gas Infrastructure Upgrades**
  With considerable natural gas needed to serve the station and number of buses, Peoples Gas upgraded the pipeline for increased capacity.

"When I drive around and see a CNG vehicle ... I feel very grateful that I've been part of the team that's brought the technology to Hillsborough County."

— Lynda Crescentini
HART Director of Enterprise Project Development

Lower emissions, reduced noise and exhaust

$1.8 million in annual fuel cost savings

Reduced unscheduled maintenance for more on-time routes

EMISSIONS REDUCTIONS

Nitrogen Oxide	93%
Sulfur Oxide	74%
Greenhouse Gases	25%

CONCLUSION

Since the transition to CNG, HART has reduced fleet emissions significantly. The reductions in 2019 alone were equivalent to removing more than 2,500 passenger vehicles from roads for a year.

While reducing emissions, HART has also been a steward of its community-funded budget by reducing its fuel costs by $1.8 million in 2020 alone.

To learn more, visit PeoplesGas.com/altfuel

At The Heart Of Florida's Energy

Thomas Holst
Senior Energy Analyst

Renewable Natural Gas: A Sustainable Approach to the Energy Transition

Renewable natural gas offers a new and promising energy source that will help decarbonize a portion of Utah's energy mix.

January 2022

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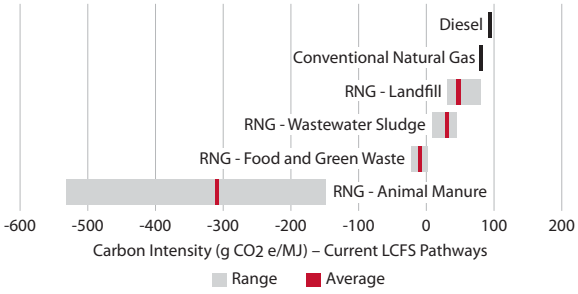
Renewable Natural Gas: A Sustainable Approach to the Energy Transition

Analysis in Brief

Renewable natural gas (RNG) offers a new and promising energy source that will help decarbonize a portion of Utah's energy mix. RNG feedstocks include waste streams from livestock, landfills, and food. By recycling these waste streams Utah will avoid the release of methane, which has a climate warming potential 25–34 times greater than carbon dioxide. Analysts estimate that Utah RNG volumes could supply 4% of Utah's fossil natural gas demand. In addition, fuel switching in 2025 at the Intermountain Power Plant will increase green hydrogen availability.

Renewable Natural Gas's Carbon Intensity Is Five Times Lower Than Conventional Natural Gas



Source: World Resources Institute, Renewable Natural Gas as a Climate Strategy; Guidance for State Policymakers

Key Findings

- **RNG is a low-carbon energy source**—Generation of RNG avoids emissions of methane, a greenhouse gas with warming potential 25–34 times greater than carbon dioxide. Avoidance of methane emissions gives RNG a negative carbon intensity metric (grams CO_2 equivalent per megajoule of energy). RNG pathways involving livestock waste, food waste, wastewater sludge, and landfill all have carbon intensities lower than fossil fuels.
- **Utah has RNG resources**—Utah's current RNG sources are food waste, landfill gas, wastewater treatment plants, and livestock farms. Potential RNG production from these sources would supply about 4% of Utah's natural gas demand.
- **There are multiple pathways to RNG**—RNG feedstock sources are limited by organic waste streams generated by the Utah population. However, another RNG pathway occurs when carbon dioxide reacts with green hydrogen created by renewable energy. Increased Utah production of green hydrogen for the Intermountain Power Plant in 2025 and 2045 will likely boost RNG supplies above current levels.
- **There are several local RNG producers**—Owners of five anaerobic digesters processing livestock waste and one anaerobic digester processing food waste fulfill a vital role in the RNG production chain. In addition, Utah has 54 landfills and 20 wastewater facilities, only some of which are capturing biogas.

Anaerobic Digestion Process

Source: Environmental and Energy Study Institute

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Climate change presents a global challenge posing risks to the environment and the economy. Companies are transitioning to low-carbon sources of energy, including renewable energies such as wind, solar, and geothermal. Nuclear technologies, now de-risked for safety concerns, will enter into Utah's energy mix in this decade.

Natural gas serves as a transition fuel to lower-carbon energy supplies due to its smaller carbon footprint than either crude oil or coal.

Interest in *renewable* natural gas (RNG) has mounted in the United States and Canada. In California, SoCalGas committed 5% of its distribution to be RNG by 2022 and 20% by 2030. In Canada, the British Columbia government will increase the percentage of its RNG distribution from the current 5% to 15% by 2030.

This report considers impacts of adding RNG into Utah's energy mix.

Introduction

RNG is a waste-derived fuel used to power homes, businesses and vehicles. RNG and the natural gas supplied to heat homes are both methane (CH_4), but their production pathways differ. RNG pathways comprise municipal solid waste landfills and anaerobic digesters, both fed by waste products. Recycling carbon already on the earth's surface avoids extraction of fossil fuels buried deep underground.

Waste products are the starting point for the RNG pathway.

Food Waste Approximately 40% of U.S. food supply is thrown away.[1] More food reaches landfills and incinerators that any other single material in our everyday trash.[2] Food waste constitutes 20% of landfills, where it decomposes in the presence of bacteria to methane and carbon dioxide. A more efficient food waste destination is an anaerobic digester that processes organic matter into sustainable resources such as RNG and fertilizer. Wasatch Resource Recovery's (WRR) anaerobic digester, located in North Salt Lake, processes deliveries of food waste into enough RNG to heat Bountiful and produce bio-based fertilizer[3].

Livestock Waste Hogs produce between 3 to 13 pounds per day of manure capable of generating up to 5 cubic feet per day of biogas, a feedstock for RNG. Smithfield Farms in Beaver County comprises 26 family farms equipped to generate RNG. Swine manure pumped from animal barns fills high-density polyethylene basins that retain and convert manure emissions into RNG capable of heating 3,000 homes.

Wastewater Treatment Wastewater treatment plants separate sewage sludge from liquids during the treatment process. Biogas from sewage sludge could potentially meet 12% of national electricity demand.[4] However, many wastewater treatment plants lack facilities to convert biogas into electricity, so they flare biogas instead.[5]

Crop Residues Quantities of corn stover, wheat straw, and forest product residues may co-digest with the wet wastes listed above. However, conversion of large amounts of woody biomass as a stand-alone feedstock requires thermal gasification technologies not yet fully mature.

Landfill Gas The Resource Conservation and Recovery Act of 1976 sets criteria under which landfills can accept municipal solid waste and nonhazardous industrial solid waste. Landfill gas captured from the anaerobic digestion of biogenic waste is methane and trace amounts of nitrogen and oxygen.

Decomposing waste products emit methane and carbon dioxide. RNG projects capture these gases from existing food and livestock waste, crop residues, and wastewater sludge, repurposing them as a green energy source. Recycling carbon already on the earth's surface avoids extraction of fossil fuels buried for millions of years. RNG is chemically identical to natural gas, but its production method differs from fossil fuel natural gas:

Fossil natural gas forms within the earth's organic-rich rock formations under high-temperature and high-pressure conditions. Natural gas comes to the earth's surface from depths of 8 to 12,000 feet through a well bore drilled by energy exploration and production companies.

RNG forms when waste products on the earth's surface decompose via bacteria to form methane and carbon dioxide and small amounts of hydrogen sulfide.

RNG is carbon neutral (i.e., no net release of carbon into the atmosphere) because it recycles carbon already in circulation on the earth's surface. The waste products creating RNG would have emitted methane into the earth's atmosphere by natural decay processes. Recycling carbon already on the earth's surface reduces the need to extract and combust fossilized carbon sources. Estimated RNG feedstock sources in Utah are in Table 2.

Terms Used in this Report

Anaerobic Digestion An anaerobic digester facilitates biological processes in which bacteria break down organic matter (e.g., animal manure, wastewater bio solids, and food waste) in the absence of oxygen. Combining multiple organic materials in one digester is a practice called co-digestion. Anaerobic digester outputs are biogas and digestate. Digestate finds application as either fertilizer or animal bedding.

Biogas Upgrading Biogas created by anaerobic digesters is a combination of methane (50%–60%), carbon dioxide (40%–50%), and trace amounts of other gases. Upgrading biogas separates methane from the carbon dioxide and hydrogen sulfide. The renewable natural gas could either be injected into a gas distribution network or used as a vehicle fuel.

Carbon Intensity The weight of carbon dioxide equivalent emitted per unit of energy released. Typical units for this measurement are grams of carbon dioxide equivalent per megajoule of energy produced.

Carbon Neutral A state of net-zero carbon dioxide emissions. RNG pathways for livestock, food and green waste *avoid* release of methane into the atmosphere, creating carbon offsets.

Dekatherm A unit of energy equal to 1 million British Thermal Units (BTUs) that measures the heating value of a specific volume of natural gas. A typical Utah residential customer consumes 80 dekatherms per year.

Electrolysis The electrolysis pathway for producing RNG involves electricity from renewable energies and carbon dioxide (CO_2). The first step is producing green hydrogen by using electricity generated from renewable energy sources such as wind or solar to split water into hydrogen and oxygen. The second step is methanation of hydrogen to produce renewable natural gas (CH_4) in the sequential reactions listed below.

Green hydrogen production:

$$2\,H_2O + \text{electric current} \rightarrow 2\,H_2 + O_2$$

Renewable natural gas production:

$$4\,H_2 + CO_2 \rightarrow CH_4 + 2\,H_2O$$

Livestock, food and organic waste streams currently used to produce RNG are limited. However, electrolysis may create unbounded RNG production.

Table 1: Hydrogen Feedstocks

Feedstock	Process	End Product
Water	Electrolysis	Green hydrogen
Natural gas	Steam Reforming with carbon sequestration	Blue hydrogen
Natural gas	Steam Reforming with no carbon sequestration	Gray hydrogen
Coal	Gasification	Brown hydrogen

Source: S&P Global Market Intelligence

Hydrogen A fuel having no carbon footprint, it is a transportation fuel for heavy-duty vehicles. Electricity generation plants now utilize hydrogen as a replacement fuel for coal and natural gas. Feedstocks in Table 1 produce hydrogen by chemical processes.

Life Cycle Accounting (LCA) LCA evaluates net impacts of emissions throughout a renewable natural gas pathway, including avoided methane emissions at the feedstock source, emissions from energy consumption for biogas upgrading, methane leakage, and end-use emissions. Emission impacts are compared to a reference case in which renewable natural gas is not produced and the feedstocks are managed according to existing practices.

Natural Gas Two sources for natural gas exist. First, fossil natural gas is methane (CH_4) produced by drilling operations providing a conduit from the deep geologic formations to the earth's surface. Second, renewable natural gas (RNG) is a fuel derived from waste streams. As organic waste decomposes, it releases a biogas having 50%–60% methane. This biogas can be refined to remove contaminants and increase heating value. RNG may substitute for fossil natural gas in pipelines, fueling stations, and storage tanks, or as a drop-in fuel requiring no engine modification in natural gas vehicles.

Organic Waste Ban A policy restricting food waste sent to landfills to avoid methane gas leaks to the atmosphere. Waste bans require restaurants or grocery stores to either donate food waste or recycle it via composting or anaerobic digestion.

Voluntary Green Pricing Utility customers voluntarily specify an amount of electricity or natural gas from renewable energy resources they will underwrite by means of surcharges. Only participating customers pay these surcharges.

Wastewater Treatment Plant A facility that removes contaminants from wastewater and converts it into an effluent suitable for return to the water cycle.

Sources: United States Environmental Protection Agency, How Does Anaerobic Digestion Work, https://www.epa.gov/agstar/how-does-anaerobic-digestion-work; Argonne National Laboratory, Greenhouse Gases, Regulated Emissions, and Energy Use in Technology model, https://greet.es.anl.gov/; World Resources Institute, Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers, https://www.wri.org/research/renewable-natural-gas-climate-strategy-guidance-state-policymakers; and Kem C. Gardner Policy Institute

Table 2: Utah Feedstocks for Renewable Natural Gas

Source		Annual RNG Feedstocks	Potential Renewable Natural Gas (billion cubic feet/yr)	Range of Feedstock Carbon Intensity (g CO_2e/MJ)
Animal Manure	Swine – 1MM	1.2MM tons manure	3.7	**(525)–(150)**
	Cows – 95,000	2.6MM tons manure		
Landfill Gas	8 landfills	2.6 billion ft^3 biogas	1.0	**40–80**
Wastewater	2 facilities	92,000 gallons sludge	0.7	**10–40**
Food Waste	Wasatch RR	1MM ton food waste	2.7	**(25)–0**
Total Utah RNG Production			**8.1**	
Utah Natural Gas Demand in 2020			**211.6**	

Source: American Biogas Council, Utah Geological Survey, World Resources Institute, Utah State Agricultural Review

The U.S. government's climate plan targets carbon neutrality by 2050.[6] Under this plan, renewable natural gas would replace fossil-fuel natural gas as a heating fuel or transportation fuel (i.e., compressed natural gas and liquid natural gas).

Renewable Natural Gas Production Cycle

RNG generates from organic waste streams with varying degrees of process control. At one end of the spectrum, organic waste brought to landfills has little processing other than hooding to capture biogas. At the other end of the spectrum, an anaerobic digester (AD) is a sealed vessel containing microbes that break down organic waste. Process controls include retention time in the AD, optimization of vessel temperatures, and maintenance of an organic waste load rate to support a healthy microbial population. Each process results in renewable natural gas (i.e., methane). Other RNG pathways are gasification and power-to-gas that rely upon chemical reactions. Gasification converts waste streams into synthetic gases leading to methane formation. Power-to-gas electrolyzes water to produce hydrogen for conversion to methane. Each RNG pathway is assessed by a life cycle emission accounting to assess its carbon intensity.

Biogas Production Landfill is the oldest and most common form of waste disposal. Landfill operators confine waste to as small an area as possible and compact the waste to reduce volume. Soil, chipped wood, or other green waste covers the compacted waste daily. Decaying organic waste creates decomposition gases such as carbon dioxide and methane, which can be collected by blanketing the landfill. Eight of 54 Utah landfills currently collect biogas. Of these eight sites, four use biogas to support on-site operations, one creates compressed natural gas for vehicles, and four flare the gases.[7]

Anaerobic digesters capture biogas from food waste, animal manure, crop residues and wastewater sludge. These digesters replicate nature's decomposition process under optimized, controlled conditions when bacteria in an oxygen-free environment break down plant and animal matter (see Figure 1). One product is biogas, composed of 50%–60% methane and 40%–50% carbon dioxide, plus solid digested material used as soil amendment.

- Biogas may produce heat and electricity for use in engines, micro turbines, and fuel cells.
- Upgraded biogas, stripped of its non-methane components, may be injected into natural gas pipelines.

Emission Benefits When RNG replaces fossil fuel natural gas, the emissions reductions improve the environment. A metric characterizing the RNG benefit is "carbon intensity" (CI), based on a life cycle emissions accounting (LCA) approach that estimates greenhouse gas (GHG) emissions associated with producing and consuming RNG. LCA impacts are compared to a reference case in which RNG is not produced and feedstocks are managed according to existing practices. Life cycle accounting steps include:

1. Avoided methane emissions at the feedstock source
2. Emissions from energy consumption for upgrading biogas to RNG
3. Methane leakage in the pipeline transport network
4. End-use emissions

Figure 1: Anaerobic Digestion Process

Source: Environmental and Energy Study Institute

The CI metric is the net grams of carbon dioxide equivalent (CO_2e) emitted per megajoule of energy over the life cycle.

RNG feedstocks (i.e., food waste, woody biomass, livestock waste, wastewater sludge, landfill biogas) have lower CI values than fossil natural gas and diesel fuel (see Figure 2).

The animal manure-to-RNG pathway has the largest negative CI (–525 to –150 grams CO_2e per megajoule of energy) because diversion of manure from open lagoons to hooded lagoons avoids methane emissions to the atmosphere. Methane is a powerful greenhouse gas with warming potential 28–34 times greater than carbon dioxide. Avoiding these methane emissions creates a large negative CI for the animal manure-to-RNG pathway.

The food/green waste-to-RNG pathway has CI's ranging from –20 to +10 grams CO_2e per megajoule of energy. However, this CI is an order of magnitude lower than the animal manure-to-RNG pathway due to transportation emissions and inconsistent quality of the food waste. That is, emissions for delivering food/green waste from widely dispersed locations (i.e., grocery stores, restaurants, food service locations) to the anaerobic digester are large relative to collecting animal manure from a herd of livestock collocated in a barn or livestock pen.

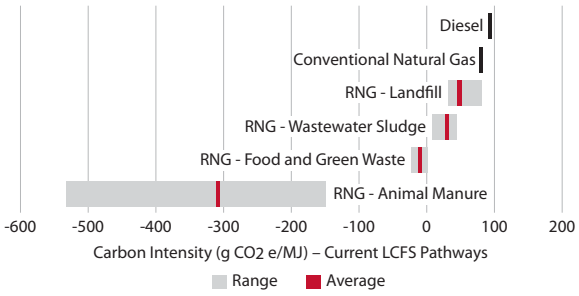
Renewable natural gas offers potential benefits in decarbonizing Utah's energy mix. However, some raise questions about 1) RNG's scalability to cover Utah's natural gas demand, 2) the economics of producing RNG, and 3) overall greenhouse gas impacts.

Scalability to Meet Demand Utah consumed 211 billion cubic feet of natural gas in 2020, with the residential sector accounting for one-third of total natural gas consumption (see Figure 3). Natural gas heats 4 in 5 Utah households.[8]

Utah's current RNG feedstocks could cover about 4% of Utah's natural gas consumption, approximating the starting points of the RNG mix ratio by both California and British Columbia utilities cited in the Overview.

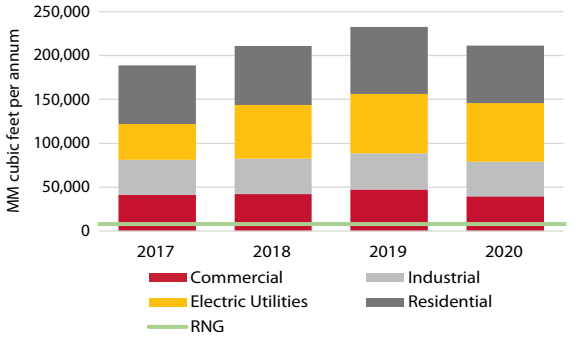
RNG production levels are currently limited by landfill, livestock, and food waste streams. However, future RNG production levels may increase when new technologies such as power-to-gas and thermal gasification are considered.

Figure 2: Carbon Intensity of RNG Feedstocks



Source: World Resources Institute, Renewable Natural Gas as a Climate Strategy; Guidance for State Policymakers

Figure 3: Utah Natural Gas Consumption, 2017–2020



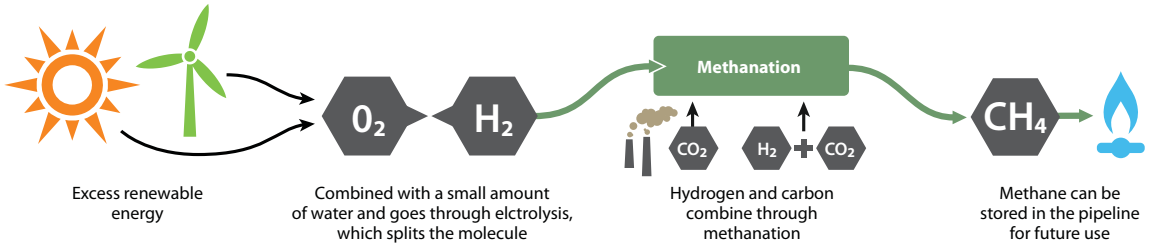
Source: Utah Geological Survey; Consumption of Natural Gas in Utah

Power-to-Gas Electricity produced from wind or solar is frequently surplus to utility system requirements because of renewable energy's intermittent generation. Utilizing this surplus renewable electricity in an electrolyzer creates oxygen (O_2) and green hydrogen (H_2). In the third unit of Figure 4, green hydrogen and carbon dioxide flow into a reactor, creating renewable natural gas (RNG) having no carbon footprint.

Green hydrogen, generated from renewable energies such as solar or wind, has no carbon footprint, whereas hydrogen from fossil fuels has higher carbon intensity. Figure 5 displays the pathways to gray, brown and blue hydrogen.

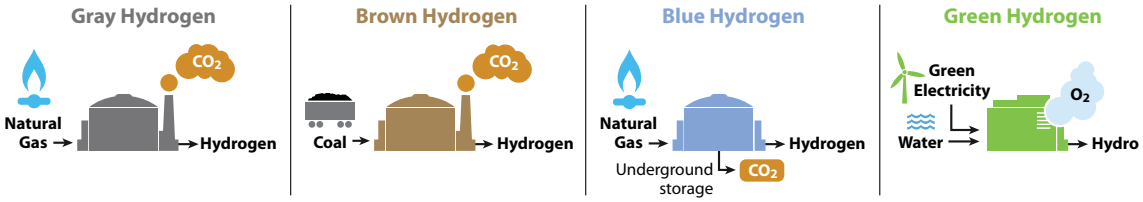
Green hydrogen will feature prominently in Utah's energy transition to lower-carbon-intensity fuels. The Intermountain Power Project (IPP) in Delta, Utah will fuel switch from coal to a mix of 70% natural gas and 30% green hydrogen in 2025. By 2045, green hydrogen will be the sole feedstock for IPP.

Figure 4: Power-to-Gas Creation of RNG



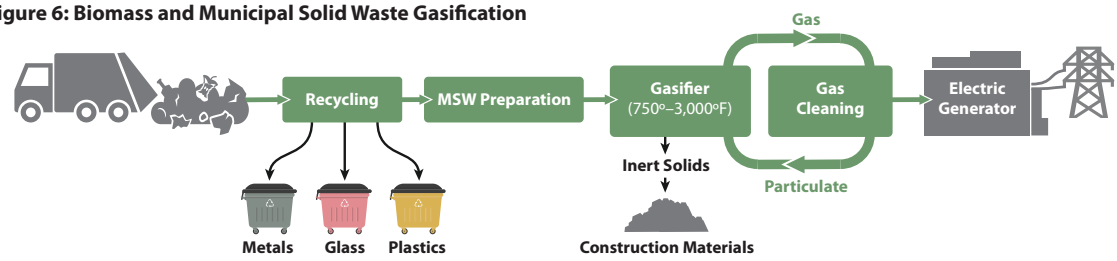
Source: SoCalGas; Imagine the Possibilities

Figure 5: Colors of Hydrogen Generation



Source: S&P Global Market Intelligence

Figure 6: Biomass and Municipal Solid Waste Gasification



Source: Zafar, Salman. (2009). Gasification of municipal solid wastes. Energy Manager, 2, 47–51; https://www.researchgate.net/figure/Schematic-of-MSW-Gasification-and-Power-Generation-Plant_fig1_285295261

Currently North America's only green hydrogen supplier, located in eastern Canada, produces 8,000 kilograms of green hydrogen per day. However, announced green hydrogen projects in North America will ramp up production to 290,000 kilograms per day by the middle of the decade.[9]

Mitsubishi Power, Magnum and Chevron formed a joint venture to produce, store and transport green hydrogen in the western United States. The joint venture, situated adjacent to IPP, will generate green hydrogen via electrolysis. This green hydrogen will be stored in an existing underground salt dome beneath IPP.

Thermal Gasification Gasification converts carbon-based raw materials such as biomass or waste products in a high-temperature/-pressure vessel into synthetic gas, an intermediate in the production of hydrogen and carbon dioxide (see Figure 6). Gasification is the leading technology for converting forest waste products and coal into hydrogen. While few gasification projects are in operation globally, this technology has potential to be a dominant waste-to-energy process. Challenges to thermal gasification include high capital costs, high operating costs, and the large scale required.

RNG's Role in Reducing Greenhouse Gas Emissions

This section examines how RNG deployment as a heating source for the residential and commercial sectors may decrease greenhouse gas emissions. The trend towards building electrification will be evaluated. Finally, RNG's utilization in heavy-duty vehicle fleets will be reviewed.

Heating Fuel in Commercial and Residential Sectors RNG diverts waste product–produced methane from entering the atmosphere, turning it into a usable energy source. Current Utah RNG potential feedstocks total about 4% of the state's natural gas demand. Injecting RNG into the natural gas stream delivered to industrial, commercial and residential sectors lowers the carbon intensity of fuel delivered by the gas utility.

Reducing carbon is a national policy interest. Natural gas delivered to commercial and residential buildings accounted for 11% of Utah's greenhouse gas emissions in 2018 (see Figure 7).

Municipalities and cities in other states have recently passed ordinances to electrify new buildings instead of delivering natural gas. Building electrification is a strategy to convert fossil fuel–based elements of daily activities to run on electricity so benefits of lower-carbon fuels are realized. However, electrification as a decarbonization strategy depends upon using electricity generated by low-carbon sources.

Comparison of electricity feedstocks in the western states illustrates how building electrification may have carbon benefits for states with low-carbon-intensity electricity, but no carbon benefits for states with higher carbon-intensive electricity (see Table 3).

In Utah, electricity is 65% coal-fired. In this situation, building electrification in Utah would increase carbon emissions relative to buildings fueled by natural gas. Utah's electricity carbon intensity emissions factor is 1.65 lbs. CO_2 per kWh, compared with the natural gas emissions factor of 0.91 lbs. CO_2 per kWh.

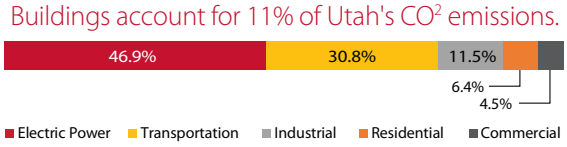
By contrast, Idaho's electricity comprises 76% renewables, the highest percentage among the western states, and 24% natural gas, long considered a transition fuel to achieve a smaller carbon footprint. More importantly, natural gas covers Idaho's baseload electricity demand when renewable energy sources become intermittent.

While newly built all-electric homes and buildings may be cost-competitive with homes using natural gas, retrofits can be considerably more expensive, depending on existing heating and cooking systems plus the cost of effectively converting them. In San Francisco, a recent study estimated costs for retrofitting a quarter million housing units using natural gas. Estimated retrofit costs ranged from $14,000 to $25,000 per unit.[10]

An alternative to the building electrification strategy has arisen. Modifying the utility natural gas streams to include RNG achieves carbon reduction. A Navigant Consulting study found that if 46% of SoCalGas natural gas delivered to residential customers were RNG, the emissions reduction would equal that achieved with building electrification.[11]

Transportation Fuel RNG also serves as a vehicle fuel occupying the same market niche as fossil-fuel natural gas. RNG converts to either compressed natural gas (CNG) or liquefied natural gas (LNG), which are both interchangeable with fossil natural gas in servicing the heavy-duty vehicle market. LNG is more expensive to produce and store than CNG, but its higher

Figure 7: Commercial and Residential CO_2 Emissions in Utah, 2018



Source: U.S. Energy Information Administration

Table 3: Western States Electricity Feedstocks, 2019

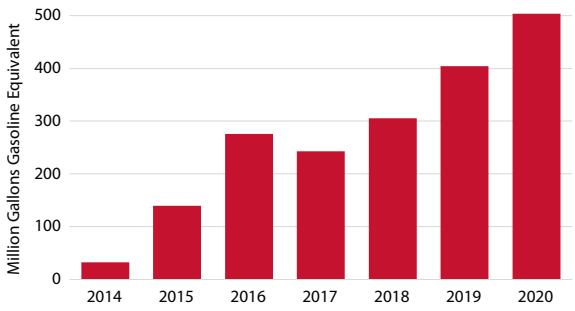
State	Coal	Renewables	Natural Gas	Petroleum	Nuclear	Total	Pounds CO_2 per kWh
Idaho	0%	76%	24%	0%	0%	100%	0.22
Washington	7%	70%	15%	0%	8%	100%	0.29
California	0%	48%	43%	0%	8%	100%	0.39
Oregon	4%	62%	34%	0%	0%	100%	0.40
Nevada	7%	28%	65%	0%	0%	100%	0.75
Arizona	20%	11%	41%	0%	28%	100%	0.82
New Mexico	42%	24%	34%	1%	0%	100%	1.26
Colorado	45%	25%	30%	0%	0%	100%	1.27
Utah	**65%**	**11%**	**24%**	**0%**	**0%**	**100%**	**1.65**
Montana	71%	7%	10%	0%	12%	100%	1.66
Wyoming	84%	13%	3%	0%	0%	100%	1.88

Note: Carbon intensity emissions factors are 2.21 lbs. CO_2 per kWh for coal, 0.91 for natural gas, and 2.13 for petroleum.
Source: US Energy Information Administration

density makes it preferable for long-distance travel. LNG and CNG are well suited to heavy-duty fleet vehicles refueling at a base location. About 9% of all U.S. heavy-duty trucks operate on natural gas.[12]

The Renewable Fuel Standard, created by the U.S. Congress in the 2005 Energy Policy Act, incentivizes blend stocks that lower greenhouse gas emissions. RNG's growth coincided with technical issues that prevented cost-effective cellulosic conversion of crop residues into liquid fuels. To fill this low-carbon fuel production gap created by technical issues, EPA administrators permitted RNG to receive incentives associated with the cellulosic category, spurring a rapid production increase from 2014 to 2016 (see Figure 8).

Figure 8: Renewable Natural Gas as a Transportation Fuel, 2014–2020



Source: U.S. Environmental Protection Agency, Public Data for the Renewable Fuel Standard

Community Benefits of Renewable Natural Gas

Benefits of renewable natural gas from waste products accrue to local and municipal operations in communities in Utah. Using biogas to generate electricity defrays operating expenses. Waste products that previously held no value are now converted into revenue streams by means of supplying renewable natural gas (e.g., Smithfield Hog Farms), transportation fuel (e.g., Bayview landfill), or electricity (e.g., Ballard, Sunderland, and Wadeland dairies).

Landfill Gas The Environmental Protection Agency's Landfill Methane Outreach Program (LMOP) tracks active landfills as well as landfills closed after 2000, since landfills continue to emit significant volumes of methane for over 20 years after closure. The LMOP database reveals the following about Utah:

- 27 of the 54 Utah landfill sites are operational.
- Eight sites collectively capture 7 million cubic feet of biogas per day, generating 10 MW electricity supporting on-site operations.
- The Bayview landfill site in Elberta will sell RNG into the transportation market starting in November 2021.

Community benefits include defraying landfill operating expenses by creating electricity and transportation-grade fuels.

Animal Manure Biogas from animal manure has high potential monetary value because its large negative carbon intensity creates credits in the federal Renewable Fuel Standard program and California's Low Carbon Fuel Standard program (see Figure 2 on page 4).

Prior to 2005, customary farm practice was to allow livestock manure to accumulate in an open lagoon, releasing methane vapors into the atmosphere. However, after Congress enacted the Energy Policy Act of 2005, programs at the federal and state level incentivized capture of methane vapors.

- U.S. Renewable Fuel Standard (RFS) The RFS credit for methane produced by animal manure from waste digesters was $22 per MMBTU during early 2021.[13] In July 2021, natural gas traded at $3.75 per MMBTU, so the RFS credit was five times the market price of fossil natural gas.
- California Low Carbon Fuel Standard The California credit for RNG was $45 per MMBTU in 2019,[14] also a large multiple of the market price of fossil natural gas.

RNG volumes sold into California's transportation market attract stackable federal and state credits. These stackable credits create large incentives to generate motor fuels from RNG created from animal manure. However, this course of action is moderated by the following factors:

- California's natural gas transportation market will eventually saturate with new supplies of RNG.
- Financing RNG projects dependent upon federal and state credits may deter financing sources averse to regulatory and market risks.

Utah currently has five farm-related operational anaerobic digesters (see Table 4).

Farms with anaerobic digesters accrue the following benefits:

- Revenues diversify because spare digester capacity may attract non-farm organic waste deliveries with the farm gaining "tipping fees" for each delivery.
- Digesters improve soil health by converting nutrients in manure into a more accessible form for plants to use.
- RNG production converts into electricity powering on-farm needs, diminishing out-of-pocket expenditures for utility electricity.
- Digesters reduce odors from livestock manure, lessening negative impacts of farm operations on local communities.

Table 4: Utah Agricultural Anaerobic Digester Facilities

Name	City	Biogas Use	Attributes
Ballard Hog Farms	Benson	Cogeneration	Animals: 650 swine Electricity: 297 MWh/year
Smithfield Hog Production	Milford	Pipeline Gas	RNG production: 240,000 dekatherms
Sunderland Dairy	Chester	Electricity	Animals: 750 dairy cows Electricity: 369 MWh/year
Wadeland Dairy	West Weber	Cogeneration	Animals: 1,200 dairy cows Electricity: 823 MWh/year
Blue Mountain Biogas	Milford	Electricity	Animals: Swine Electricity: 3.2 MWh/year

Source: US Environmental Protection Agency, AgSTAR Livestock Anaerobic Digester Database

Wastewater Treatment Plants Utah has 20 wastewater treatment plants. The Central Valley Reclamation Facility (Salt Lake County) and the North Davis Sewer District (Davis County) use methane from anaerobic digesters to supply heat and power for plant operations. Each location has approximately 3,300KW of power demand. Electricity generated on-site covers approximately 85% of power demands, with the balance supplied by the local utility. Both locations provide bio-solids to fertilize alfalfa hay crops and turf grass production.

State Policies Supporting Renewable Natural Gas

The U.S. federal government recently rejoined the Paris Climate Accord and aims for carbon neutrality by 2050. Several states have assumed leading roles in adoption of RNG initiatives. This section examines financial incentives for anaerobic digesters, organic waste bans, and addition of RNG into fossil natural gas supplied by utilities.

Financial Incentives States have created financial incentives for capital equipment such as anaerobic digesters and pipeline infrastructure needed to inject RNG into existing natural gas infrastructure. Incentives include:

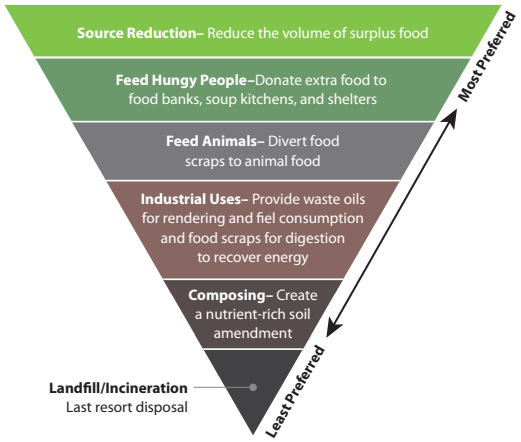
1. Direct state payments to defray capital expenditures. California SB457's monetary incentive program supports dairy cluster projects needing interconnecting pipelines to reach natural gas infrastructure.[15]
2. Tax exemption for RNG equipment. Washington State grants a 75% exemption on sales taxes for anaerobic digesters,[16] effectively reducing the sales tax rate from 6.5% to 1.6%. The capital cost of an on-farm anaerobic digester ranges from $400,000 to $5 million depending on the number of livestock and technology.[17] However, on the assumption that a typical on-farm anaerobic digester costs $1.2 million pre-tax, the tax savings in Washington would amount to roughly $60,000 per anaerobic digester.
3. Cost recovery of RNG capital equipment. Oregon's SB98 instructs the public utility commission to "ensure recovery of all prudently incurred costs," contributing to a laddered progression of RNG goals through 2050 set by lawmakers, starting at 5% in 2024 and peaking at 30% in 2050. Oregon's public utility commission confirmed the economic feasibility of Oregon utility ratepayers funding the buildout of RNG infrastructure.

Organic Waste Bans New York's legislature passed the 2019 Food Donation and Food Scrap Recycling Act, a step forward in preventing food waste, rescuing surplus wholesome food for those in need, and recycling any remaining food scraps.

Forty percent of food in the U.S. is wasted. Food amounts to 18% of the solid waste streams sent to landfills, where decomposing organic materials release methane into the atmosphere. If global food waste were a country, it would be the third largest emitter of methane after the United States and China.[18] Redirecting food waste to anaerobic digesters avoids methane release and creates RNG.

The Environmental Protection Agency frames the food waste issue in humanitarian terms. Ideally, food production would match demand, thereby saving land, water, and energy tied to food waste. The next highest priority is alleviation of hunger, while creation of energy is the lowest priority (see Figure 9).

Figure 9: Recovery of Food Waste



Source: Natural Resources Defense Council

State Legislatures and Public Utility Commissions Adding RNG into fossil natural gas deliveries to rate-paying utility customers would incur additional costs such as biogas upgrading and interconnections services from a cluster of hog farms to the utility pipeline.

Two regulatory principles potentially impede RNG integration into fossil natural gas delivered to ratepayers. Public utility commissions govern utility rates, allowing utilities to recover capital asset investments with an associated rate of return. The "least cost" regulatory principle requires utilities to demonstrate their investments represent the lowest-cost option while maintaining reliable service. The "used and useful" principle requires assets be physically used and useful to current ratepayers before those ratepayers pay the costs associated with them.

State legislatures have introduced innovative policies by issuing instructions to the public utility commission, implementing pilot programs to include environmental benefits in the assessment of the "least cost" determination, or allowing ratepayers to self-select for higher utility payments.

Issuing Instructions When Oregon's legislature passed SB98 in 2019, the legislature instructed the public utility commission to adopt a statewide rule to implement RNG target goals while providing a ratepayer protection plan against higher costs due to biogas conditioning and interconnection services. SB98 states that the natural gas utility's incremental annual costs may not exceed 5% of "total annual revenue requirement," thereby protecting Oregon ratepayers from excessively higher costs.

Pilot Programs Utilities may narrowly define an RNG pilot program in order to gain flexibility on the "least cost" regulatory principle. Nicor Gas, an Illinois natural gas utility, obtained pilot program approval from the state's public utility commission to interconnect RNG into Nicor's natural gas distribution system.

Table 5: Vermont RNG Adder Costs

Blend Ratio with Fossil Natural Gas	Annual Cost
10%	$112
25%	$280
50%	$559
100%	$1,118

Notes: Annual residential natural gas consumption is 90,000 cubic feet. The fossil natural gas price was $13.14 per thousand cubic feet. Source: Vermont Gas

The Illinois ruling permits capital investment up to $16 million and allows Nicor Gas to collect an associated tariff.

Voluntary Green Premium Program Making an RNG program voluntary allows self-selection by individual ratepayers for higher costs, avoiding the "least cost" regulatory requirement for this subset of ratepayers willing to pay a "green premium." Vermont Gas allows residential and commercial ratepayers to select an RNG blend percentage. Participants pay an "adder" price based on the difference in cost between fossil natural gas and RNG. Ratepayers choose RNG program participation at various tranches (e.g., 10%, 25%, 50%, and 100%) of their monthly natural gas usage. Table 5 shows levels of estimated "adder" costs for the Vermont program.

Dominion Energy initiated its own voluntary green premium program, GreenTherm, in 2020. Ratepayers elect a number of green attributes added as a surcharge to their monthly gas bill. A green attribute certifies production of RNG and the surcharge acknowledges environmental benefits from carbon-free fuels. A typical Utah residential customer consuming 80 dekatherms per annum would pay $400 annually for RNG attributes. By capturing methane released from organic waste and repurposing it as RNG, the program reduces contributions to climate change and improves air quality.

Conclusion

Renewable natural gas facilitates decarbonization of Utah's energy mix. RNG feedstocks comprise waste streams from livestock, landfills and food. Recycling these waste streams avoids the release of methane, which has warming potential 28–34 times greater than carbon dioxide. Life cycle accounting of RNG pathways enables policymakers to assess environmental benefits.

Utah RNG volumes could supply 4% of Utah's fossil natural gas demand. Blending Utah's current RNG production volumes with fossil natural gas would approximate the starting point for RNG introduction set by California and British Columbia utilities.

Power-to-gas and thermal gasification technologies could enable RNG growth. Power-to-gas is likely in Utah because fuel switching in 2025 at the Intermountain Power Plant will increase green hydrogen availability.

State policies and local utility actions in Oregon, Washington, California, Illinois and Vermont facilitate RNG growth by offering financial incentives for investment in anaerobic digesters. Cooperation between the state legislatures and public utility commissions has facilitated commingling of renewable natural gas and fossil natural gas while providing ratepayer protection against higher costs due to biogas upgrading and interconnection to utility pipelines.

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SPONSORED CONTENT

Renewable natural gas is more than a viable option

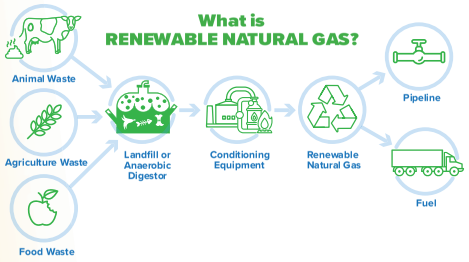
Peoples Gas is investing in its promise for Florida

As Florida grows, so does the need for reliable and more sustainable energy that is affordable for all.

Power production is innovating and reducing greenhouse gas emissions with significant contribution from natural gas. Solar production is expanding, and the development of energy storage and other solutions are evolving so we have more energy options becoming available and economical. One emerging resource for Florida is renewable natural gas.

Renewable natural gas – or RNG – is waste gas that is essentially purified. Through the process, methane that would otherwise be emitted into the atmosphere is captured and cleaned. It can then be blended into the natural gas supply within the pipeline system, or put to direct use for power generation or as a fuel alternative for transportation vehicles. RNG works just like natural gas so there's no difference in performance with appliances, industrial equipment, or buses, trucks and ships. While natural gas is a fossil fuel, naturally occurring and contained within the rock underneath the Earth's core, RNG is produced locally on-site from biological materials like livestock waste, landfills, food waste, or other types of organic waste.

For those producing waste gas, farmers, landfill and wastewater treatment operators for instance, the production of RNG helps reduce the cost of waste removal, lower overall methane emissions from the operation, and generate a new revenue stream. Utilities like Peoples Gas can increase gas supply and improve reliability while reducing carbon intensity. More specific for fleet operators, RNG displaces carbon-heavy fuels like diesel and has the lowest carbon-intensity of all transportation fuels. Since 2014, RNG production has grown more than ten-fold across the U.S. to help the transportation industry meet environmental goals.



Renewable Natural Gas (RNG) is an energy source made from garbage and waste. After it's cleaned, it can be used for homes, businesses and vehicles.

Florida's RNG potential

With more than 2,000 wastewater treatment plants, dairy farms and landfills, Florida ranks 13th in the U.S. for methane production potential from biogas sources and RNG capacity according to the American Biogas Council.

RNG, like natural gas, is efficient and versatile energy. It can be used directly or as a reliable backup, especially for other renewable sources. For instance, there is enough RNG potential here to support increased solar energy use. When the sun isn't shining and there isn't enough solar energy stored to serve demand, RNG is available to provide consistency and resiliency. Peoples Gas is Florida's largest natural gas distributor and is key to bringing RNG to the state.

Current RNG Investments

Peoples Gas is invested in Florida's first RNG facilities – with additional projects in development.

Larson Dairy

Located in Okeechobee, the RNG system includes two biogas conditioning facilities to clean waste gas from cow manure to pipeline-quality gas for injection into the interstate natural gas pipeline system to serve natural gas customers across Florida.

Peoples Gas has developed and built pipeline and interconnection infrastructure to move the biogas to the conditioning facilities and then deliver the conditioned gas to the interstate pipeline system.

The Larson Dairy project is expected to generate enough RNG to fuel about 5,700 homes a year. The facility will offset 57,000 metric tons of greenhouse gas emissions, equivalent to planting 75,000 acres of forest each year.

New River Landfill

Located in Raiford, the RNG system will condition biogas from the New River landfill to inject into the interstate natural gas pipeline system.

Peoples Gas has developed and built and will own all pipeline and interconnection infrastructure to deliver the RNG to the interstate pipeline system.

The New River project should generate enough RNG to fuel 17,000 homes a year and reduce the landfill's methane emissions by about 14,000 tons per year and help avoid emissions by more than 34,000 tons per year.

Alliance Dairy

Located in Trenton, the RNG system will clean waste gas from cow manure to pipeline-quality gas for injection into the interstate pipeline.

Peoples Gas has developed, built, and will own and operate the processing plant and all related pipeline and interconnection infrastructure.

The Alliance Dairy project is expected to generate enough RNG to fuel about 4,400 homes a year.

Learn more about renewable natural gas. **PeoplesGas.com/RNG**

Scan for an informative video.

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Peoples Gas System, Inc.
Capital Projects Summary

Capital Category	Project / Expenditure	2022	2023	2024
Growth	CNG Fueling Stations	$ 700,669	$ -	$ -
Growth	FGT to Jacksonville Export Facility	-	32,648,919	48,249,446
Growth	Main-New River	5,003,448	583,008	-
Growth	RNG Biogas Lines Brightmark	1,790,552	9,500	-
Growth	RNG Equipment Alliance	3,028,764	1,678,410	-
Growth	RNG Pipe - Brightmark	2,729,251	999,096	-
Growth	RNG Pipe Alliance	1,289,063	(984,919)	-
Growth	RNG Station Brightmark	180,743	33,192,324	-
Growth	CNG Pipe Orlando	108,675	-	-
	Subtotal Growth	**$ 14,831,165**	**$ 68,126,336**	**$ 48,249,446**
Reliability, Resiliency, and Efficiency	Blue Marlin LNG	$ (6,251)	$ -	$ -
	Subtotal RRE	**$ (6,251)**	**$ -**	**$ -**
Total		**$ 14,824,914**	**$ 68,126,336**	**$ 48,249,446**