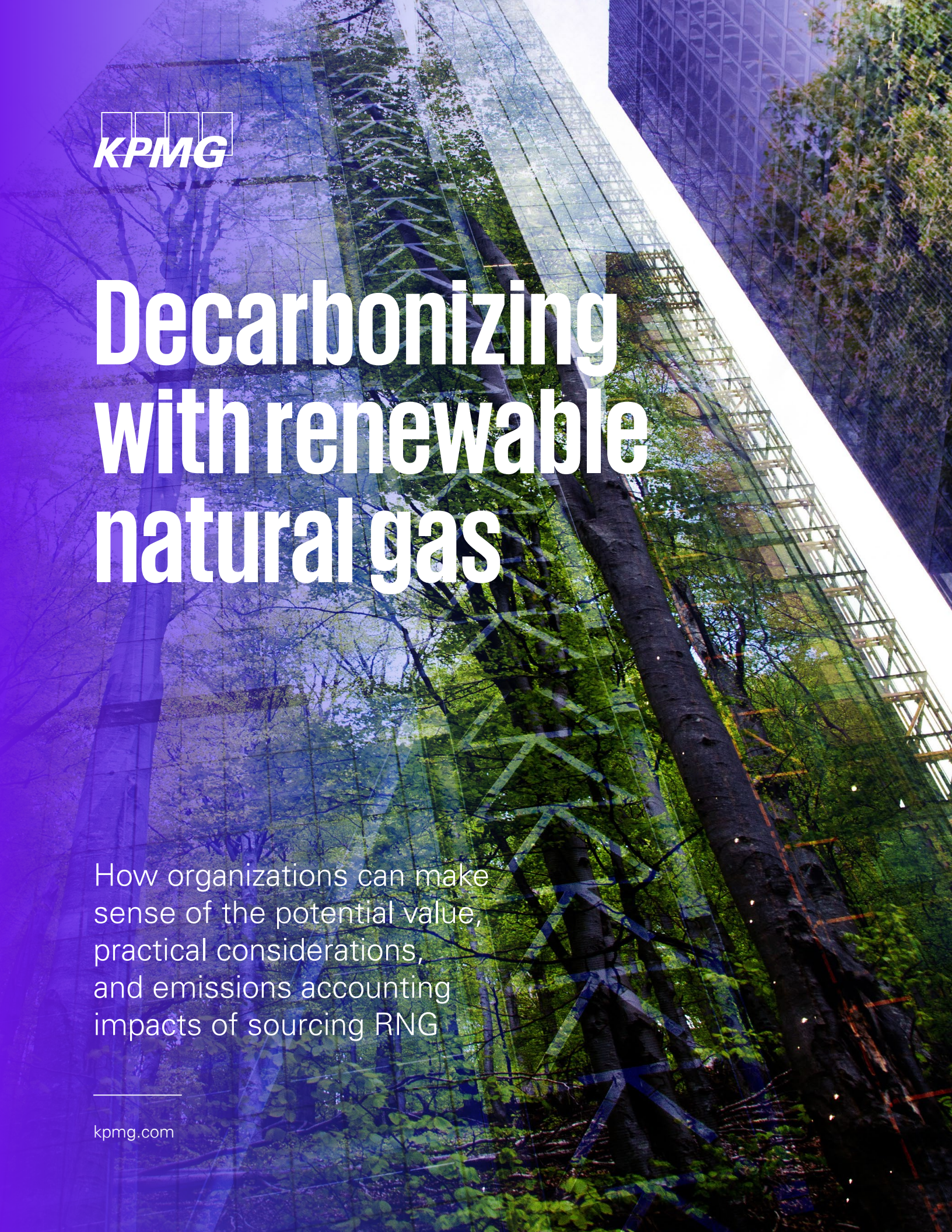

KPMG

Decarbonizing with renewable natural gas

How organizations can make sense of the potential value, practical considerations, and emissions accounting impacts of sourcing RNG

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Introduction

As RNG emerges as a green energy solution for organizations, additional clarity is needed around its procurement, verification, and emissions impacts

Renewable natural gas (RNG) is increasingly gaining recognition as a promising renewable fuel—especially in hard-to-abate use cases—given its unique environmental properties.[1] In recent years, the number of RNG production facilities in the U.S. has grown significantly, increasing from just 30 production facilities in 2011 to over 300 in summer of 2023.[2] Recent research suggests that existing organic waste streams are sufficient to eventually produce enough RNG to replace up to 7 percent of the natural gas consumed in the U.S.[3]

There are several strategic and environmental benefits from the use of RNG because it can be used across an array of energy applications to help organizations meet sustainability and carbon reduction goals. However, organizations need a firm understanding of RNG use cases, procurement considerations, and emissions reporting to optimally utilize this fuel in their operations. Unfortunately, many organizations lack sufficient clarity on how to procure RNG, how to verify that it is renewable, and how to account for its emissions impacts. The emissions accounting guidance is often unclear and inconsistent, which can lead to confusion about its value.

This paper is intended for organizations that are considering sourcing renewable energy, particularly RNG—it explains RNG's benefits for decarbonization and hard-to-abate use cases, and also covers the procurement process, verification, and emissions reporting implications, helping organizations make informed decisions about RNG and its potential impact on their sustainability goals.

[1] "Renewable Natural Gas as a Climate Strategy: Guidance for State Policymakers," World Resources Institute

[2] Tom DiChristopher, "Gas utilities see renewable natural gas investment opportunities expanding," S&P Global Market Intelligence, August 10, 2023

[3] "Beyond Hydrogen: Renewable Natural Gas and Deep Decarbonization," Ameresco white paper

What RNG is, and how it can support decarbonization

RNG, also known as biomethane, is a biogas that has been procured and upgraded for use in place of fossil natural gas. The biogas used to produce RNG typically comes from two sources:

1. Landfill methane gas produced during the decomposition of organic waste in landfills. This gas can be collected, purified, and fed into natural gas pipelines.
2. Methane gas produced from utilizing an anaerobic digestor with any of the following feedstocks:
   - Agricultural waste from animal manure and livestock operations, as well as food processing waste and crop residuals
   - Organic municipal solid waste from residential, commercial, and industrial sources
   - Wastewater treatment plant residuals
   - Wood waste from forestry operations and the manufacturing of wood products
   - Crops such as corn that are grown specifically for the purpose of producing biogas and converting it to RNG

RNG is particularly valuable in applications such as industrial processes and thermal needs, where few renewable alternatives exist.

RNG can be used on site or injected into natural gas transmission or distribution pipelines. Additionally, RNG is often used as a transportation fuel, particularly as a substitute for diesel in heavy-duty vehicles. According to recent research, 69 percent of natural gas vehicles worldwide are powered by RNG.[4]

[4] "Renewable Natural Gas Breaking Motor Fuel Usage Records," NGVAmerica, April 13, 2023

Some uses for RNG

Thermal applications for heating and cooling

Transportation fuel

Industrial processes

Electricity generation

A bio-product feedstock for refineries

Opportunities for hard-to-abate use cases

RNG may be used with existing infrastructure to help decarbonize a range of hard-to-abate end uses.

Heating

Heating is one of the primary uses for natural gas in the U.S., providing both the residential and commercial sectors with space and water heating as well as combined heat and power.

In some buildings, replacing natural gas heating systems with electric systems based on renewables like solar may not be physically or economically feasible based on the existing building structure and parameters. This makes RNG a good alternative to fossil natural gas and other traditional energy sources.

Industrial uses

In 2022, the industrial sector accounted for about 32 percent of total U.S. natural gas consumption, and natural gas was the source of about 41 percent of the U.S. industrial sector's end-use energy consumption.[5]

Since RNG is chemically identical to natural gas, it can be used to decarbonize large-scale and complex industrial manufacturing processes that are dependent on natural gas as a compound in the production process.

[5] "Natural gas explained," U.S. Energy Information Administration

GHG emissions reduction with RNG

RNG can offer clear environmental advantages compared to fossil natural gas. For example, if an RNG project captures and recovers waste methane (CH_4) from a landfill, then the use of RNG can have little or no upstream GHG emissions including carbon dioxide (CO_2) and CH_4—which has a global warming potential 29.8 times greater than CO_2—meaning its emissions are very potent. Reducing these emissions contributes significantly to mitigating climate change.

Benefits of RNG

GHG emission reductions: The use of biogas does not contribute to human-caused emissions of CO_2. This is because biogas emissions are already part of the natural carbon cycle, whereas burning fossil natural gas adds new CO_2 to the atmosphere and ultimately increases global emissions levels.

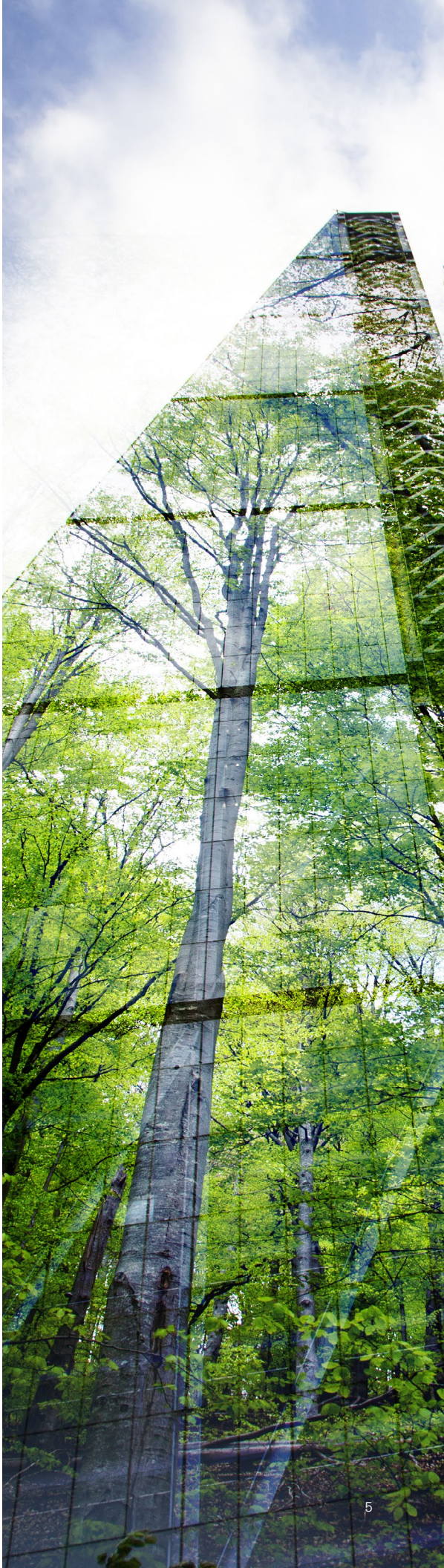
Local air quality benefits: Replacing traditional diesel or gasoline with RNG can significantly reduce emissions of nitrogen oxides and particulate matter, resulting in benefits to local air quality.

Improved water quality: The anaerobic digestion process that produces biogas is a cost-effective treatment of livestock manures and sewage biosolids, decreasing the runoff of nitrogen, phosphorus, and pathogens into ground water and other water resources.

Better waste management: In an oxygen-free environment, organic wastes (like food waste and sewage) naturally release a methane-laden biogas as they decompose. Capturing biogas incentivizes more thorough, holistic management of organic waste. The remaining solids can be recycled for use as animal bedding on farms, and even incorporated into building materials.

Energy reliability: RNG and RNG-derived hydrogen are storable and dispatchable, supporting energy reliability in a cost-effective manner. Such reliability holds significant value for food storage, universities, hospitals, and other mission-critical facilities where loss of power could have catastrophic impacts.

Fuel diversity and availability: The use of RNG increases and diversifies energy production, as it can easily replace natural gas across a range of applications. RNG leverages existing infrastructure such as pipelines and heavy-duty vehicles.



Case studies

RNG in action

Cornell University adopts an innovative solution for winter heating demands

Cornell University is located in upstate New York where the winters are chilly and operations require over six months of heating for campus buildings. In 2020, the university announced plans to develop a system to extract RNG-based energy from cattle manure, helping to meet peak demands for winter heat while also supporting the university's goal of net-zero carbon emissions by 2035.[7]

Using dairy manure from the university's own farms, the heating system involves a three-stage process. The manure is first biologically digested with microbes to produce biogas, a mixture of carbon dioxide and methane. The second stage involves converting the digested manure into a type of biocrude oil. The final stage combines the carbon dioxide generated in the first step with hydrogen gas produced by renewable electrolysis of lake water to biologically generate RNG.

The proposed system is expected to produce about 909 million liters of RNG per year, providing 97 percent of the total annual peak heating demand.

University of California looks nationwide to source RNG

The University of California System (UC) has developed a flexible RNG procurement strategy involving both in-state and out-of-state projects. This strategy is an integral part of UC's goal to reach net zero Scope 1 and Scope 2 emissions by 2025 and displace 40 percent of its fossil natural gas consumption with RNG by 2030.[8]

UC is partnering with Archaea Energy, one of the largest RNG producers in the U.S., to develop a biomethane project in San Bernardino County that will capture and clean methane from an existing landfill.[9] The facility expects to generate 900,000 MMBtus of RNG annually for electricity, heating, and cooling by all 10 UC campuses.

UC has also invested $21 million to build a RNG facility at a landfill in Shreveport, Louisiana and signed an agreement to purchase RNG from an anaerobic digester that converts agricultural waste in Denmark, Wisconsin. RNG generated from both facilities will not be used by UC campuses. However, under California's Cap and Trade Program, UC can count RNG from these out-of-state projects as zero-carbon fuel.

"UC is leading the state's transition to carbon neutrality with these long-term investments in renewable electricity and biogas," said David Phillips, associate vice president of UC's department of Energy and Sustainability. "We started this journey 11 years ago and we are well down the road to achieving our goals, goals that will benefit all of California."[9]

[7] "Cornell University to Extract Energy From Manure to Heat the Campus," SciTechDaily, January 8, 2021

[8] RNG Biomethane Case Study, Renewable Thermal Collaborative, University of California System, September 2022

[9] "Investments in new California projects move UC nearly halfway to its clean energy goals," University of California, October 21, 2020

How RNG procurement and verification works

Organizations generally procure RNG the same way that they procure traditional natural gas—through existing distribution systems. In this case, RNG is mixed with traditional natural gas, but the organization still has an option to account for the sourcing of the RNG through the well-established concept of the book-and-claim system.

How RNG is procured

Many large, energy-consuming organizations can use a combination of the following strategies to procure RNG:

Long-term contract: This involves an agreement between the offtaker and an RNG supplier that establishes fixed terms and prices for a specific volume of RNG over a set period of time. The contract can provide price stability and security of supply, but it also comes with some risks and may be less flexible in case the offtaker's needs change. Contract periods are typically 15 to 20 years in duration.

Energy broker: Energy brokers assist in market analysis and energy procurement and management. These brokers have extensive knowledge of the RNG market and can help organizations find the best prices and terms for their needs. This option can provide convenience and expert guidance, but it may also come with additional fees. Working through as broker can be beneficial for industries looking for assistance in navigating the complex and specialized RNG market.

Spot markets: With spot markets, RNG is bought and sold at current market prices, without any long-term commitment. This option provides the most flexibility, but it can be subject to price volatility and may not guarantee a steady supply.

Self-sourcing: An RNG producer and/or an offtaker may choose to develop their own RNG production facilities or collaborate with a biogas or RNG producer. This option provides the highest level of control and may offer additional environmental and branding benefits, but it also requires significant investment and operational resources.

How RNG sourcing is claimed

Book-and-claim systems are used to allow organizations to buy clean energy and claim its renewable attributes. The molecules of clean energy that enter a shared distribution system—such as electricity transport through a grid or gas transport through a pipeline—cannot be directly traced from buyer to seller. Consequently, book-and-claim systems work by having a contracted amount of clean energy added to a distribution system and creating documentation in the form of an energy attribute certificate (EAC) to give a single entity the ability to claim responsibility for the energy's renewable attributes. Certificates are exchanged between the buyer and seller to show that the clean energy was bought and used. The buyer retires the EACs when it reports its emissions to prevent double-counting.

In some cases, on-site delivery of RNG is also an option if the RNG source is located in the same location as a significant demand for natural gas (such as a waste treatment site), enabling self-sourcing of RNG to take place.

What are RNG certificates and credits?

RNG certificates are a type of EAC that help businesses and individuals purchase clean energy to meet renewable energy requirements or goals. Different types of EACs for RNG are available depending on whether RNG is being used as a fuel or to produce electricity, and third-party verified certificates are available that enforce emission reduction standards so businesses and individuals can buy verified certificates with confidence.

Multiple cross-national, regional, and state-level book-and-claim systems have emerged to track renewable EACs, including RNG EACs. These tracking systems document generator information (including RNG feedstock type), location, quantity of energy, and whether this energy has already been "retired" or claimed as a renewable energy credit (REC) or renewable thermal credit (RTC). While an EAC is a certificate of energy attributes, renewable credits provide certificates to apply the RNG usage to one's mandatory or voluntary emissions reporting.

There are two types of RNG credits:

- When RNG is used for electricity generation, a REC is issued.
- Meanwhile, RTCs are issued when renewable fuel is injected into a pipeline (or other point for customer use) for later consumption and subsequent data is uploaded on the tracking system.

To avoid double counting of RNG credits, tracking systems record the legal ownership of a given quantity of RNG. The EAC certification of ownership entitles an organization "to account for the emissions associated with this quantity of energy or RNG as a credit (REC or RTC) to meet their mandatory or voluntary emission reduction requirements.

Many states in the U.S. have renewable portfolio standards (RPS) that require fossil fuel power producers to limit their carbon emissions by procuring RECs and RTCs. Meanwhile organizations voluntarily committed to carbon reductions may similarly opt to procure RNG RECs or RTCs.

How are RNG credits verified?

To both satisfy RPS and voluntary emission reduction requirements, organizations often seek third-party verified RECs and RTCs to ensure that the renewable resource is high quality, has not already been retired or "double counted," and has traceable generator information.

The Green-e certification program provides EAC verification and more specifically provides renewable fuel certification (RFC) for RNG sales in the U.S. and Canada. A Green-e RFC requires RNG producers to show documentation of carbon emission reductions from their RNG compared to traditional natural gas.[11] RFCs are created when a producer submits their production information to Green-e. In doing so, their RNG and associated REC and/or RTCs (depending on whether the RNG is used for electricity or injected into a pipeline) are available for purchase on Green-e's website and marketplace.

RFCs enable organizations who would like to purchase RNG credits to make verifiable emission reduction claims when retiring of these credits for the purposes of documenting carbon emission reductions for reporting.

In sum, there are multiple book-and-claim systems that document RNG EACs, including current ownership, ownership history via any trades, and active/retirement status. Organizations fulfilling RPS requirements may apply their ownership of EACs directly to use these certificates as RECs or RTCs to meet carbon emission reduction requirements. Similarly, organizations meeting voluntary emission reduction requirements may opt to apply their EACs directly as credits, or intentionally procure credits that are already Green-e verified as high-quality.

[11] "Green-e® Renewable Fuels Standard," PDF, September 16, 2021

RNG impacts on emissions reporting: an example

The GHG Protocol defines terms and provides guidance related to the emissions from RNG that can be leveraged to calculate emissions for organization that use it. In the following example, two types of RNG—biogas from anerobic digestion of sewage/food waste and landfill gas—are shown as examples for RNG used to generate heat and electricity such as in a combined heat and power/cogeneration system.

Emissions from an organization's own generation typically fall under Scope 1 emissions. However, there is a nuance with emissions from biogenic feedstocks—the carbon emitted through the combustion is NOT considered part of Scope 1 emissions since it is carbon that is already part of the natural carbon cycle—that carbon would have been emitted with the decomposition of the biomaterial at the end of its lifetime. Carbon emissions are instead calculated and reported in a fourth category "Outside of scopes;" this category accounts for all natural carbon cycle emissions that are not within the boundaries of Scopes 1, 2, and 3. Scopes 1, 2, and 3 carbon emissions are all anthropogenic or human-induced. Emissions of other Greenhouse gases—namely, methane and nitrous oxide—do count toward the Scope 1 or 2 emissions from RNG use as they would not have otherwise occurred if the biomaterial was not used as biogas.

Scope 1 emission calculations

Natural gas (NG)	kWh of NG consumed	**CO2 Emissions – kg CO2e** (NOT reported within Scopes 1–3 when biogenic)			**Other GHG emissions – kg CO2e** (Methane and Nitrous Oxide – always reported as Scope 1or 2)		**Total Scope 1 emissions**
		Emission factor kg CO2e per kWh	Total biogenic emissions from CO2	Total Scope 1 emissions from CO2	Emission factor kg CO2e per kWh	Total Scope 1 Emissions from CH4 and N2O	
Biogas anerobic digestion (RNG)	10,000	0.19902	1,990	0	0.00022	2.20	**2.2**
Landfill gas (RNG)	10,000	0.19902	1,990	0	0.00020	2.00	**2.0**
NG (fossil)	10,000	0.20000	0	2,037.9	0.00041	4.10	**2,042**

Next, to calculate Scope 3 emissions from the RNG combustion, the organization would look at GHG protocol guidance to calculate Scope 3, Category 3 fuel, and energy-related activities to account for the upstream RNG emissions. It will need to consider which Scope 3 Category 3 activities are applicable to them and identify an upstream or lifecycle emission factor. Upstream Scope 3 Category 3 emissions are much more emission intensive than Scope 1 emissions for RNG. In this case, upstream Scope 3, Category 3 emissions for anerobic digestion biogas are over 129 times greater than Scope 1 emissions, meanwhile total anerobic digestion biogas emissions of 286.2 kgCO2e are over 143 times greater than total landfill gas emissions of 2.0 kgCO2e.

Scope 3, Category 3 emission calculations

Natural gas (NG) types used in trucks	kWh of NG consumed	kgCo2e of per kWh	Scope 3 Category 3 from NG
Biogas (anerobic digestion)	10,000	0.02841	284
Landfill gas (RNG)	10,000	0	0
NG (fossil)	10,000	0.03347	335

That said, both forms of RNG are far less emission intensive than fossil natural gas, which has 2,042 kgCO2e of Scope 1 emissions and 335 kgCO2e of Scope 3 Category 3 emissions. In this example, if this organization switches from fossil natural gas to anerobic digestion biogas their total emissions would be reduced by 88% and switching to landfill gas would reduce emissions even further by 99.9%.

Total Scope 1, 2, or 3 emissions summary from use case

Natural gas (NG) types used in trucks	Total Scope 1–3 emissions in kgCO2e	Total biogenic emissions in kgCO2e (outside of Scope 1–3)
Biogas (anerobic digestion)	286.2	1,990.0
Landfill gas	2.0	1,990.0
NG (fossil)	2,377.0	0.0

How an organization sources RNG is an important consideration for calculating upstream emissions. Biogas from anerobic digestion is a net new operation dedicated to RNG, whereas landfill gas uses are based on methane from an existing operation, so they are considered as zero upstream emissions, according to the U.K. Department for Environment, Food and Rural Affairs (DEFRA) that issues emission factors for emission calculations. As such, determining the feedstock or source of RNG is imperative to evaluating the efficacy of corresponding GHG emission reductions.

Closing comments

Like any innovative technology, the full benefits of RNG for organizations will become more apparent only after widespread adoption by organizations with a variety of energy needs, energy mixes, and regulatory requirements. Different RNG projects depending on their feedstocks might have different carbon-intensity, and many organizations, whether public or private, have unique objectives regarding low-carbon energy generation.

How KPMG can help

KPMG helps organizations evaluate their RNG options in alignment with their sustainability policies, financial responsibilities, business models, market strategies, and other strategic goals.

KPMG offers a dedicated team of professionals with years of knowledge and experience in renewable energy, environmental sustainability, and decarbonization. Key objectives in a typical engagement involving RNG contracts include the following:

- Understanding current reporting requirements by different governing bodies
- Determining which governing regulatory bodies apply to the organization
- Identifying external factors that can affect the organization and its decarbonization efforts
- Developing commercial terms for RNG contracts
- Following best practices in RNG accounting and reporting
- Staying abreast of continually evolving regulations
- Maintaining the ability to adapt to changes in regulations and guidance

Talk to KPMG today

Learn how KPMG can help organizations like yours to analyze the economic and sustainability impact of RNG investments, as well as the transaction structuring of potential RNG contracts.

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DASD-2023-13500