

The Future of Clean Energy

Lead the transition to low-carbon energy by producing and using renewable natural gas

- Organic waste
- Agriculture
- Wastewater treatment
- Landfills
- Food and beverage processing

Inside:

The RNG advantage

How is RNG produced and used?

RNG vs. electrification

Expert help to get started

An aerial photograph of a farm at dusk or dawn. In the foreground, there are large, conical silos covered in pink material, situated next to several farm buildings with red roofs. The middle ground shows a large, flat field, possibly a cornfield, with rows of crops. The background features a dense line of trees and rolling hills under a soft, golden light. The overall scene is a mix of agricultural infrastructure and natural landscape.

Get expert help planning and developing your RNG projects

This booklet will guide you through everything you need to know to produce and use renewable natural gas (RNG) with Enbridge Gas. We'll help you leverage RNG as an effective solution to achieve climate action goals and create a sustainable future for your company and community.

From organic waste to renewable energy

RNG will play an important role in Ontario's clean energy future



RNG is produced from **organic waste, landfill gas, agricultural sources** (such as manure) and **wastewater treatment**.



RNG has the potential to power various sectors of our economy, such as **fuelling transit fleets, powering industry and heating homes**.



What is RNG?

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The RNG potential in Canada is 36%* of its 2017 natural gas consumption.

RNG: a smart strategy

Created from gases released when organic waste decomposes, this carbon-neutral fuel provides a proven source of energy that also helps manage waste, reduce carbon emissions and fight climate change.

Fuel the future

Utilities across Canada have set ambitious RNG targets, aiming to have a five percent blend of RNG in all natural gas streams by 2025 and 10 percent by 2030. This would result in a 14 MT reduction of greenhouse gas (GHG) emissions by 2030—equivalent to taking 3.1 million cars* off the road.

* Source: cga.ca/natural-gas-101/the-renewable-natural-gas-opportunity

Benefits of RNG



A circular economy approach

RNG turns organic waste into renewable energy that can be used in business, industrial, residential and transportation applications.



A sustainable energy source

Low-carbon energy is created by capturing and cleaning landfill gas or biogas. The digestate (byproduct of anaerobic digestion) can be converted into fertilizer, returning valuable nutrients back into the soil.



A path to net zero

RNG can help reduce GHG emissions by capturing methane that would otherwise be released into the atmosphere.



A clean energy network

RNG is delivered through the existing natural gas infrastructure where it can be used to heat homes and businesses.



A cost-effective solution

RNG is an effective way to reduce CO2 emissions and manage costs.

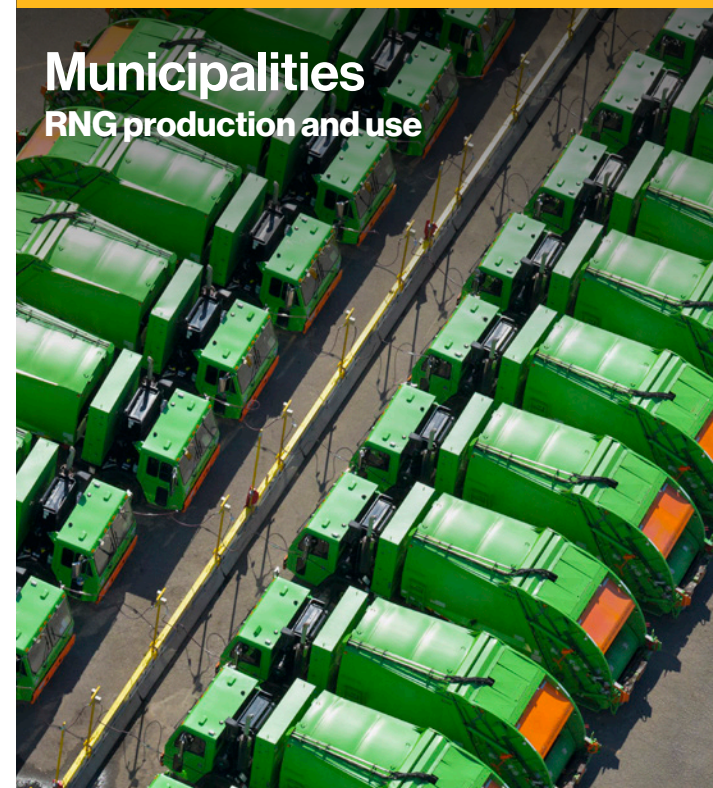


An effective way to create energy resilience

As the RNG supply is distributed by underground pipes, it is reliable and resilient against extreme weather conditions.

How you can benefit from RNG

From fuelling vehicles to creating a new revenue source, many sectors across Ontario can benefit from this sustainable energy source.



Municipalities RNG production and use

With oversight on landfills, water waste, energy infrastructure and transit, municipalities are ideally positioned to produce RNG and also use it as a sustainable energy source.

- Meet climate change and sustainability goals by reducing GHG emissions.
- Make waste management more effective and reduce the need for landfill.
- Fuel transit and waste truck fleets with compressed RNG or blended CNG. Heat buildings with blended RNG.
- Strengthen your local economy and infrastructure.
- Use the existing natural gas infrastructure to distribute RNG.
- Manage costs and reduce CO2 emissions, compared to electrification.



Food and beverage processors RNG production and use

For facilities where natural gas usage can account for a significant portion of energy use, RNG can help manage waste and energy costs while reducing CO2 emissions.

- Reduce carbon emissions by using natural gas blended with RNG to fuel buildings and processes, or use compressed RNG or blended CNG to fuel fleets.
- Leverage existing natural gas infrastructure to inject and distribute RNG.
- Achieve corporate sustainability goals by reducing your carbon footprint.
- Get better energy value with the most affordable renewable energy.
- Avoid downtime with more resilient, reliable service compared to electricity.



Waste management companies RNG production and use

Waste management companies can take advantage of a new revenue opportunity by producing and selling RNG.

- Repurpose organic waste by turning it into clean RNG.
- Instead of flaring, capture methane to produce RNG and create a new revenue stream.
- Reduce emissions by fuelling fleets with compressed RNG.
- Meet sustainability and environmental goals.



Agribusinesses RNG production

RNG can be created from your agricultural waste, resulting in a new revenue stream.

- Earn new revenue from the production of RNG.
- Reduce your GHG emissions.
- Gain an effective waste management solution.
- Be part of a growing biogas sector forecasted to grow up to 50 percent in the next five years.*
- Return soil nutrients by using the RNG byproduct as fertilizer.

How is RNG made and used?

RNG is created by capturing methane emissions from organic waste, landfills and wastewater treatment plants. A renewable source of energy, it can be injected into our natural gas network and used for residential and commercial energy needs as well as transportation fuel.

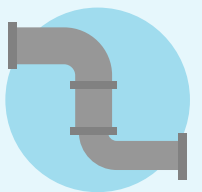
Unlike fossil fuels, RNG is created from:



Food processing organic waste



Agricultural waste, such as leftover crops and animal manure



Bio-solids from wastewater treatment plants



Landfills

1

Waste recovery

Organic waste, such as wastewater treatment sludge, food waste or manure is delivered to a biodigester.

2

Anaerobic digestion

The biodigester breaks down the organic waste, creating biogas. The byproduct of anaerobic digestion, digestate, can be converted into fertilizers that return nutrients back to the soil.

3

Upgrading

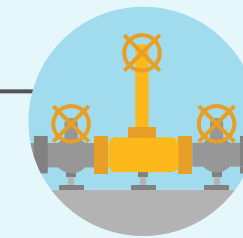
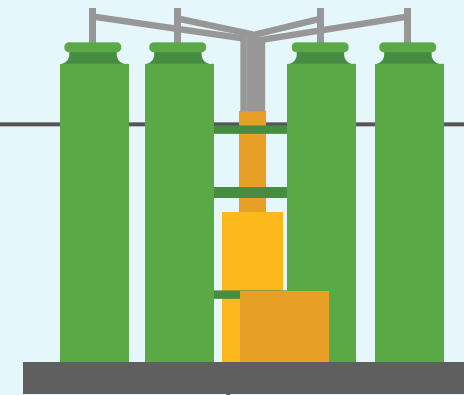
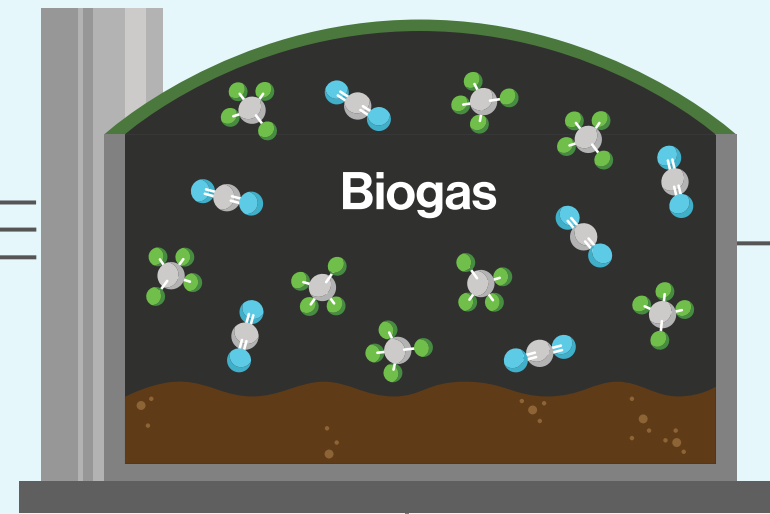
- The biogas is cleaned to meet gas quality specifications.
- Landfill gas is captured and sent directly for upgrading.

4

Added to system

The resulting RNG is added to the existing natural gas infrastructure to be sold and distributed to customers—either directly into the pipeline or to fuel the producer's own needs.

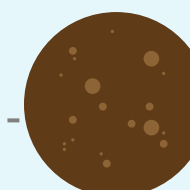
If we harness only **10%** of Canada's potential, RNG can help heat up to **one million homes for one year.***



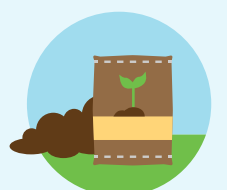
Homes and businesses



Fuel fleets



Byproduct / digestate



Fertilize soil

Why RNG is more effective than electrification

Electrification is not the only way to meet climate change goals—RNG is an immediate and effective approach. When added to conventional natural gas, it's a cost-effective, reliable and low-carbon alternative to electricity.

5 reasons to choose RNG over electrification



1 With net-zero emissions, RNG is a more cost-effective way to meet climate change goals.



2 Natural gas has fewer service interruptions than electricity, and is resilient against extreme weather, flooding and other natural disasters.



3 RNG leverages the existing natural gas infrastructure and vehicles rather than requiring investment in new electrical infrastructure.

4 RNG doesn't contribute to peak electricity demand, which can lead to higher costs to generate, transmit and distribute electricity.



5 By repurposing organic waste, RNG reduces GHG emissions.

See how a municipality can benefit from RNG

An illustrative example of how RNG is a smart, economical solution to achieve climate change goals

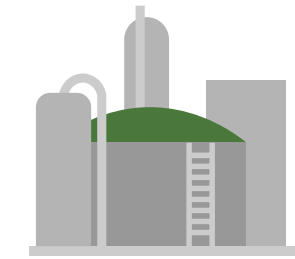
Each year, this municipality:



Consumes **50 million m³** of natural gas.



Processes **75,000 tonnes** of organics.



It can produce **5 million m³*** of RNG—about 10% of its annual natural gas consumption.

In this example:

- RNG costs \$24/GJ—equivalent to \$0.09/kWh.†
- Electricity in Ontario is priced at \$0.119/kWh.‡
- Enbridge Gas can design, build and maintain the municipality's RNG upgrading and injection infrastructure for approximately \$0.05 – \$0.10/m³ in addition to its natural gas commodity cost.



Will reduce CO₂ emissions by **9,381 tonnes** annually



Over three years, this will save **\$1.125 million** in avoided carbon charge.**

Let Enbridge Gas help you get up and running

Contact our RNG experts to create a custom plan for your community.

enbridgegas.com/rng

* Source: biogasassociation.ca/images/uploads/documents/2015/municipal_guide_to_biogas/Municipal-Guide-to-Biogas-2015March.pdf
 † Source: cga.ca/wp-content/uploads/2020/08/RNG-Handbook-for-Municipalities-in-the-GTHA_2020-07-07.pdf
 ‡ Source: oeb.ca/rates-and-your-bill/electricity-rates (Mid-peak pricing as of July 2021)
 ** Source: canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/putting-price-on-carbon-pollution/technical-briefing.html (2020 at \$30/tonne, 2021 at \$40/tonne, 2022 at \$50/tonne)

Success stories

Dufferin Solid Waste Management Facility



Toronto transforms about 35% of organic waste into RNG

The City of Toronto harnesses the biogas emitted from processing its Green Bin organic waste. The resulting RNG is added to the existing natural gas system and used to fuel the city's waste collection fleet.

It's a smart, circular solution that helps the city achieve ambitious climate change goals while diverting waste from landfill.

By the numbers

Processes

55,000 tonnes
of organic waste.

Contributed to producing approximately

3.3 million m³
of RNG from the cleanup and conditioning of about 6 million m³ of biogas.

Eliminates

9,000 + tonnes
of CO₂ emissions.

Hamilton Water Treatment Plant



RNG curbs emissions at Hamilton's water treatment plant

To reduce emissions created from its water treatment process, Hamilton's Woodward Avenue water treatment plant now captures raw biogas to produce heat and power through a cogeneration unit. The surplus gas is purified and used to create RNG.

By the numbers

Processes up to

10,000 m³*
of RNG per day.

Offsets more than

1,100 tonnes[†]
of CO₂ annually.

* Source: biogasassociation.ca/index.php/featured_member/member/the_city_of_hamilton

† Source: hamilton.ca/government-information/news-centre/news-releases/green-energy-doors-open-see-how-hamilton-generates

Success stories

Hamilton Street Railway



How Hamilton fuels fleets for less

After realizing the cost of diesel was on the rise, the City of Hamilton expanded its fleet with more than 130 new CNG buses and received funding for a new CNG station.

Proven results

Highest capacity

Now the highest capacity station in Ontario.

Fast fuelling times

Comparable to diesel pumps.

95% fewer emissions

Fewer tailpipe emissions helps improve air quality and answers climate change goals.

StormFisher



StormFisher unlocks the value of organic waste

At their facility in London, Ontario, StormFisher converts organic waste to RNG. The process captures methane, which would otherwise be released into the atmosphere. The experts at Enbridge Gas helped StormFisher upgrade their biogas to RNG and seamlessly connect to the natural gas system with capital support, access to industry experts and more.

By the numbers

Processes over **70,000 tonnes** of organic waste from restaurants, grocery stores and other food businesses.

Eliminates over **8,000 tonnes** of GHG emissions.

Produces over **3 million m³** of RNG.

Success stories

City of Hamilton and Hamilton Street Railway



Ontario's first carbon-negative bus paves the way to RNG-fuelled transit

Hamilton, Ontario residents can enjoy a cleaner commute on a bus powered by RNG. As RNG is produced from organic waste, the entire process—from diverting methane to displacing diesel emissions—takes its total net emissions to below zero. No other transit fuel—not even electricity—can achieve this.

A proven circular economy approach

A made in Ontario

waste-to-energy solution.

Uses RNG produced at the **StormFisher** Biogas Facility in London, Ontario.

Will divert **450 tonnes** of organic waste from landfill – equivalent to taking 185 cars off the road for a year.

Support to produce RNG

Whether you're planning for RNG facilities or ready to start selling, Enbridge Gas is here to help you with expertise, support and financing.

1

Feasibility



Determine your opportunity

Get a free assessment to determine whether your facility is suited to produce RNG.



Assess your facility's capacity

We offer three studies to check your facility's capacity and injection capabilities.

① Interconnection Capacity Study

This study verifies that your facility:

- Is at market capacity to receive the gas and complies with Enbridge Gas' distribution network system pressure standards.
- Meets safety requirements.
- Is designed within Enbridge Gas' peak demand considerations.

Your Enbridge Gas Business Development Specialist may need additional preliminary information such as the proposed location, volume of raw biogas or RNG and the station/pipeline requirements.

This study takes approximately 4 - 6 weeks.

② Preliminary Engineering Study

If we determine that the proposed project requirements can be met, we'll help develop cost estimates for the project. Estimates may include construction, land acquisition, site development and regulatory and environmental permits.

This study takes approximately 3 - 4 weeks.

③ Detailed Engineering Study

Once we confirm that the proposed project meets the requirements, we'll continue to the final step, which includes:

- A detailed description of all construction costs.
- Complete engineering construction drawings.
- All construction and environmental permit applications and right-of-way acquisition requirements.

A service contract is required, and a backstop agreement or indemnification letter may also be needed.

This study takes approximately 6 - 8 weeks.



2

Production



Produce your own biogas

You plan, build and maintain the anaerobic digester to turn organic waste into biogas.



Upgrade your biogas to RNG

Once you start creating biogas, we offer a turnkey solution to help you upgrade it to pipeline-quality RNG. This includes:

- Capital support to design, build and manage a new biogas upgrading system and injection station.
- Access to industry experts in engineering and construction.



The value of RNG is clear:

- ✓ Equivalent to approximately \$0.09/kWh.*
- ✓ Low-carbon.
- ✓ Reduces CO2 emissions.
- ✓ Can be blended into natural gas applications.



3

Selling and using your RNG



Inject your RNG into the pipeline

With pipeline-ready RNG, you can inject it into the Enbridge Gas system. Our experts will handle everything to get your RNG connected to the pipeline, including adding safety odourants and all metering.



Get your RNG into market

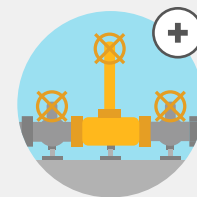
After you inject your RNG into the Enbridge Gas system, the natural gas will need to be transported to its end market. We provide:

- Access to an established network of brokers that can help distribute and sell your RNG through the natural gas system.
- Help to transport and store your RNG supply.



Your opportunity to use RNG

For even greater environmental impact, we can help you get to net-zero emissions by using the RNG you produce to heat buildings or to fuel fleets.



Cleanup and injection rates

The cost for each service would be specific to the location of the project and based on fully allocated costs. For both rates, a consistent monthly service fee over the term of the contract ensures cost certainty for RNG producers, an important factor to help enable and facilitate RNG production in Ontario.

Fuel fleets with compressed RNG

At roughly the same price as diesel, converting fleets to compressed RNG is a cost-effective way to reduce emissions, protect human health, improve air quality and achieve climate targets.



RNG's proven transit benefits

1. An effective way for municipalities to achieve net zero.
2. Fully interchangeable with conventional natural gas.
3. A more immediate and cost-effective solution than electric transit.

Market-ready, with no upfront incremental capital required:

Enbridge Gas' turnkey, all-inclusive Municipal Transit program offers Ontario communities an immediate, cost-effective way to improve air quality and reduce costs.

The program covers:

-  **The incremental cost of buses***
-  **Design, construction, operations and maintenance of compressed RNG fuelling stations**
-  **Maintenance facility upgrades**
-  **Training and change management**



6 reasons to switch diesel buses to RNG

Some believe that electrification is the only way to achieve a clean energy future. Here's why RNG comes out ahead:

- 1. One-to-one bus replacement**
RNG buses have comparable range and performance to diesel vehicles.
- 2. More cost-effective than electric**
The price of an RNG bus is about half the price of an electric bus, and about 10 percent more than a diesel bus.
- 3. Better refuelling and performance**
RNG buses refuel as quickly as diesel and can operate in the extreme cold.
- 4. RNG can be carbon negative**
The process — from diverting methane to displacing diesel emissions — can take total emissions to below zero. Electric can only achieve carbon neutrality when using renewable sources.
- 5. RNG is carbon-pricing exempt**
RNG (or even a blend of RNG) is an immediate way to mitigate fuel cost increases.
- 6. Reliable and resilient**
More reliable than above-ground energy distribution systems, which are susceptible to climate and weather events.



* Based on 100 buses. Can be scaled to suit the needs of your community.

Understanding gas quality requirements

Gas quality

This section covers the pipeline gas quality specifications for any RNG injection into the gas distribution system.

1. Pipeline gas quality specifications for renewable natural gas

To be injected into the utility gas system, the RNG must meet the following specifications.

1.1 Heating value

The specifications are:

- The minimum gross heating value of the RNG delivered must be 36 MJ/m³.
- The maximum gross heating value of the RNG delivered must be 41.3 MJ/m³.

1.2 Freedom from objectionable matter

The specifications are:

- RNG must not contain any contaminants, particles, or other impurities at a concentration that is known as a threat to the integrity of the system, human health, or the environment.
- RNG must be commercially free from bacteria, siloxanes, ammonia, halocarbons, heavy metals, sand, dust, gums, crude oils, lubricating oils, liquids, chemicals, or compounds used in the production, treatment, compression, or dehydration of the gas or any other objectionable substance in sufficient quantity that renders the gas toxic, unmerchantable, or causes damage to or interference with the proper operation of the lines, regulators, meters, or other appliances through which the gas flows.
- Internal Enbridge Gas limits to quantify commercially free amounts:
 1. 3 mg of ammonia per m³ of gas.
 2. 1 mg of silicon per m³ of gas for siloxanes.
 3. 10 mg of fluorine and 1 mg of chlorine per m³ gas for halocarbons.
 4. 80 µg of mercury and 190 µg of arsenic per m³ gas for heavy metals.
 5. 50,000,000 total bacteria, 1,000,000 live bacteria and 10,000 spores per 100 ft³ gas for bacteria.

1.3 Other specifications

The specifications are:

- RNG must have the Wobbe Number from 47.2 MJ/m³ of gas to 51.2 MJ/m³ of gas.
- RNG must not contain more than:
 - 2.0 mol % of carbon dioxide in the gas.
 - 0.4 mol % of oxygen in the gas.
 - 0.5 mol % of carbon monoxide in the gas.
 - 4 mol % of total inert gas.
 - 65 mg of water vapour per m³ of gas.
 - 2 mol % of hydrogen in the gas subject to an engineering assessment for each specific RNG project to identify impacted equipment sensitive to hydrogen, e.g. gas turbines, stationary reciprocating gas engines, steel tanks in CNG vehicles.
 - 7 mg of hydrogen sulphide per m³ of gas.
 - 6 mg of mercaptan sulphur per m³ of gas.
 - 100 mg of total sulphur per m³ of gas.
 - 1.5 mol % of butane plus (C4+) in the gas.
- RNG must not have a cricondenthem hydrocarbon dew point exceeding -8 C (18 F).
- RNG temperature must not exceed 43 C (109 F).
- Enbridge Gas may reduce maximum allowable gas temperature upon its discretion if downstream equipment is sensitive to high temperature.

Table 1: Renewable natural gas— pipeline gas quality specifications

		Value	Unit	Comment
Heating value	HV	36.0 – 41.3	MJ/m ³	
Wobbe number	WN	47.2 – 51.2	MJ/m ³	
Carbon dioxide	CO ₂	2	mol %	
Oxygen	O ₂	0.4	mol %	
Carbon monoxide	CO	0.5	mol %	
Total inerts		4	mol %	
Water vapour	H ₂ O	65	mg/m ³	
Hydrogen	H ₂	2	mol %	Subject to an Engineering assessment.
Hydrogen sulphide	H ₂ S	7	mg/m ³	
Mercaptans		6	mg/m ³	
Total sulphur	S	100	mg/m ³	
Butane plus	C ₄ +	1.5	mol %	
Cricondenthem		-8	C	
Ammonia	NH ₃	3	mg/m ³	Internal Enbridge Gas limits to quantify commercially free amounts.
Siloxanes	Si	1	mg Si/m ³	
Halocarbons	F, Cl	F: 10, Cl: 1	mg/m ³	
Heavy metals	Hg, As	Hg: 80 As: 190	µg/m ³	
Bacteria	Total, live, spores	Total: 50,000,000 Live: 1,000,000 Spores: 10,000	#/100 ft ³	

About Enbridge Gas

Enbridge Gas Inc., formed on Jan. 1, 2019 from the amalgamation of Union Gas and Enbridge Gas Distribution, is Canada's largest natural gas storage, transmission and distribution company based in Ontario with a more than 170-year history of providing safe and reliable service to customers. The distribution business serves about 3.8 million customers, heating over 75 percent of Ontario homes. The storage and transmission business offers a variety of storage and transportation services to customers at the Dawn Hub, the largest integrated underground storage facility in Canada and one of the largest in North America. Enbridge Gas Inc. is owned by Enbridge Inc., a Canadian-based leader in energy transportation and distribution.

See the areas we serve



Ready to get started?

Partner with our RNG experts



Our dedicated team of energy experts are ready to provide you with the technical expertise and information to produce and use RNG.

Connect
with an expert

✉ rng@enbridge.com

🖥 enbridgegas.com/rng

