NGIF ACCELERATOR

INDUSTRY GRANTS PROGRAM

GLOBAL GAS INNOVATION CALL

CHALLENGE STATEMENT


Canadian Natural
ENBRIDGE
FORTIS BC
Energy at work
PNG
PACIFIC NORTHERN GAS
SaskEnergy
TOURMALINE
CGA
APEX UTILITIES INC
ARC RESOURCES LTD.
ATCO
BIRCHCLIFF ENERGY
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Introduction

The natural gas industry is at a pivotal point where meeting growing energy demands must align with advancing environmental performance and operational excellence across the entire value chain. The Global Gas Innovation Call is designed to accelerate the commercialization of high-impact innovations that enhance efficiency, reduce emissions, and improve the sustainability of natural gas production, transmission, and end-use applications. This competition supports promising technologies spanning three strategic focus areas: Sustainable Energy Innovations that optimize energy efficiency and system resiliency; Low-Emission Gas Innovations that reduce carbon intensity through carbon capture and renewable gas pathways; and an Open Category for other transformative solutions addressing critical operational and environmental challenges in the natural gas sector. Through a competitive, market-driven selection process, the Global Gas Innovation Call aims to advance innovations from development and pilot-scale readiness toward demonstration and early commercial adoption, delivering measurable environmental benefits, improved economic value, and scalability across Canada's natural gas industry.

1. Sustainable Energy Innovations

Context

Sustainable operation of the entire natural gas value chain is essential in ensuring the efficient transportation, processing, distribution and end-use of natural gas. By improving energy efficiency, the industry can reduce greenhouse gas emissions and enhance sustainability. The use of multiple energy sources (such as electricity and natural gas) can also enhance the overall resiliency of the energy system, ensuring a safe and reliable energy supply during varying conditions, and further supporting energy security.

Challenge Statement

The natural gas industry is seeking transformative technologies from across the globe to increase the energy efficiency and resiliency of the natural gas value chain. The objective is to develop scalable, economically viable technologies that can integrate seamlessly into the Canadian natural gas infrastructure, reducing energy consumption and enhancing system resiliency. The following are guided measures for submitting innovations for this technology class. Innovations do not need to meet the criteria at the time of application. Priority will be given to innovations that can demonstrate their current state and a plan to progress toward achieving the target criteria.

Performance and Cost Efficiency: Technologies must demonstrate significant improvements in energy efficiency compared to existing solutions, with a focus on reducing both capital expenditures (CAPEX) and operating expenses (OPEX).

Environmental and Safety Impact: Technologies should have minimal environmental impact and no adverse safety implications.

Resiliency: Be able to operate gas appliances during power outages

For residential HVAC equipment:

- **Installation dimensions:** The proposed solution should be compatible with forced air systems and support plug-and-play installation. The physical dimensions and aspect ratio should be similar to those of cold-climate air source heat pump units.
- I**ntegration into existing furnace and air conditioning systems:** Technologies should seamlessly integrate with current natural gas infrastructure and operations, offering beneficial synergies. The proponent should demonstrate how the proposed system will integrate alongside existing/future AC systems (e.g., outdoor unit placement, plenum airflow restrictions, etc.).

Areas of Interest

1.1 Energy Efficiency (TRL 5+)

- Advanced high-efficiency burners and combustion optimization systems
- Innovative gas-fired energy efficient equipment
- Monitoring, automation, and control technologies that improve operational performance
- High-performance materials, coatings, or system designs that reduce losses
- Process optimization tools or equipment that reduce fuel or electricity consumption across industrial or commercial operations
- Next-generation furnace and burner systems with improved thermal efficiency

1.2 Waste Heat Utilization & Heat Recovery Systems (TRL 5+)

- Innovative Industrial, commercial, and residential heat recovery solutions for all grades of waste heat
- Generators that convert waste heat into electricity (example: Thermoelectric Generators)
- Advanced Rankine or modified Rankine cycle systems with higher efficiency (20%+) and lower impact working fluids
- Alternative cycles to Rankine cycle to convert low-medium grade heat (<150 °C) to electricity
- Exhaust heat recovery technologies for compressor stations and gas turbines

1.3 Natural Gas Heat Pumps (TRL 6+)

- Gas engine-driven heat pumps for residential or commercial applications
- Absorption heat pumps for high-efficiency heating and cooling
- Adsorption heat pumps using advanced sorbent materials
- Hybrid electric-gas heat pump systems for peak performance and flexibility
- Reversible gas heat pumps capable of both heating and cooling in cold climates
- Performance specifications for natural gas heat pumps:
  The natural gas heat pump system should have a technology development pathway to demonstrate a wide range of capacity and a COP ideally exceeding 1.4. It should also be able to operate in cold climates down to minus forty (-40°C) without requiring a supplemental energy system.

1.4 Heating, Cooling & Power Generation (TRL 5+)

- Expander technologies for power recovery and improved system efficiency (example: Turboexpanders)
- High-performance cogeneration and trigeneration units for heat, cooling, and power
- Integrated heat, cooling, and power generation systems for remote or off-grid locations
- High-efficiency natural gas based cooling systems for data centres and industrial facilities
- Hybrid heating for commercial operations and facilities
- Self-powered systems for gas-fired appliances, including fuel cells or microgeneration technologies

1.5 Natural Gas Resiliency of End-Use Residential Appliances (TRL 5+)

Resiliency for the scope of this funding call entails natural gas solutions that have the capability to continue functioning in the event of a power loss or an emergency. Technologies include:

- Integrated natural gas–electric hybrid systems that maintain operation during grid disturbances
- Small-scale power and natural gas systems that enhance reliability for remote or critical loads
- Appliances or systems with improved durability, reliability, or operational flexibility under variable conditions

- Backup or self-powered technologies that ensure continuous operation of residential gas appliances

2. Low-Emission Gas Innovations

2.1 Carbon Capture, Utilization and Storage (TRL 7+)

Context

The natural gas industry requires tailored CCUS technologies to address the unique deployment scenarios across the natural gas value chain. The natural gas industry, encompassing upstream (exploration and production), midstream (transportation and processing), and downstream (commercial and home distribution), is pivotal in meeting global energy needs.

Flue gases contain lower CO_2 concentrations:

- Lean combustion uses: Across all operations, natural gas combustion flue gases have a lower CO_2 concentration compared to traditional solid or liquid fuel combustion systems, typically 3 – 6 mol%.
- Boilers: 8 – 10 mol% CO_2 concentrations.
- Gas-fired heaters: 10 – 12 mol% CO_2

Flue gas CO_2 quantities span a wide range, depending on the combustion scale and application:

- Domestic and light commercial facilities: e.g. residential boilers at 1 – 50 tonnes/day
- Medium commercial and smaller scale industrial facilities: e.g. fired heaters at conventional gas production sites at 50 – 100 tonne/day
- Mid-scale industrial facilities: e.g. gas compressors at 100 – 300 tonne/day
- Large-scale industrial facilities: e.g. large once-through boilers, hydrogen production and large-scale power generation facilities at 300 – 1000 tonne/day

This funding call seeks transformative CCUS solutions tailored to the unique needs of the natural gas industry and end-use natural gas customer applications, from processing plants to utilizing (preferably CO_2 EOR) and storing it effectively to minimize GHG emissions impact.

Challenge Statement

The natural gas industry is seeking transformative CCUS technologies that can significantly mitigate carbon emissions across upstream, midstream, and downstream natural gas operations and provide performance metrics significantly better than advanced amine-based capture systems.

The following are guided measures for submitting innovations for this technology class. Innovations do not need to meet the criteria at the time of application. Priority will be given to innovations that can demonstrate their current state and a plan to progress toward achieving the target criteria.

1. **CCUS performance and cost efficiency:** Technologies targeting at least 40% lower avoided cost of CO_2 than a benchmark amine (30% monoethanolamine (MEA)) based post-combustion capture system. These performance improvements include one or more metrics, such as a reduction in capital expenses (CAPEX), operating expenses (OPEX), and capture energy requirements. The avoided cost assessment must account for both direct and indirect CO_2 reductions.
2. **CO_2 Purity:** Technologies should achieve a high level of CO_2 purity (~>95 mol % CO_2). Lower purity levels may be acceptable if there are significant CAPEX/OPEX savings, depending on the end use (or storage) of the CO_2.
3. **CO_2 Capture Efficiency:** Technologies should focus on economic capture targeting more than 85% of CO_2 emissions rather than higher 95% targets.
4. **Environmental and Safety Impact:** Technologies should have a minimal land-based footprint and no adverse environmental or safety impacts
5. **Additional energy requirements for the CCUS facility:** An understanding of the additional utilities (electricity, natural gas, water, etc.) to operate the CCUS technology will be beneficial.

Technologies not of Interest: Direct air capture, incremental improvements to the benchmark MEA amine-based capture systems.

Areas of Interest

1. **Absorption Systems:** Include, but not limited to innovative and material improvements above advanced amine-based solvents, chilled ammonia processes, dual-alkali absorption systems, non-aqueous amine systems, and phase-changing solvents.
2. **Adsorption Technologies:** Include, but not limited to Pressure Swing Adsorption (PSA) with zeolites, Temperature Swing Adsorption (TSA), Vacuum Swing Adsorption (VSA) systems, Metal-Organic Frameworks (MOFs), and carbon molecular sieves.
3. **Membrane Processes:** Include, but not limited to polymeric membranes, inorganic membranes, mixed matrix membranes, facilitated transport membranes, and membrane contactors for gas-liquid absorption.

4. **Oxy-combustion processes:** combustion systems using pure oxygen or oxygen-enriched air) to generate steam and/or power with materially reduced CO_2 avoided costs.
5. **Residential/Commercial Solutions:** Include, but not limited to micro-scale carbon capture for gas appliances and compact, integrated capture systems.
6. **Synthetic Fuels from CO_2:** Include, but not limited to methanol synthesis via CO_2 hydrogenation, Fischer-Tropsch process for synthetic diesel, syngas production from CO_2 and H_2, and electrochemical CO_2 reduction to formic acid.
7. **Carbon-neutral Chemicals**: Urea synthesis from CO_2 and ammonia, polycarbonate production, dimethyl ether (DME) synthesis, salicylic acid production, and cyclic carbonates for polymer precursors.
8. **Bioremoval Solutions:** Integration with bioremoval solutions such as utilizing biochar for CO_2 sequestration or leveraging microbial processes for carbon capture and CO_2 conversion.
9. **Mineralization:** Technologies to facilitate the storage and/or utilization of CO2 through chemical reactions.
10. **Digital solutions:** Digital solutions can facilitate the optimization of CCUS technologies, their integration into facilities, and the assessment of the full life cycle reduction in GHG emissions.

2.2 Renewable Natural Gas (TRL 5+)

Context

The natural gas industry, particularly in its midstream and downstream sectors, is pivotal in meeting global energy needs by transporting, processing, and distributing natural gas to commercial and residential consumers. However, there is an urgent need to integrate renewable energy sources to reduce the environmental footprint and enhance sustainability. Renewable Natural Gas (RNG), produced from various organic waste materials through biogas upgrading, offers a viable solution. Enhancing the production, upgrading, and integration of RNG into existing natural gas infrastructure can significantly lower greenhouse gas emissions and support the transition to a more sustainable energy future.

Challenge Statement

The natural gas industry is seeking transformative technologies to advance the production and integration of Renewable Natural Gas (RNG). In the midstream sector, innovative solutions are needed for upgrading biogas to pipeline-quality RNG and ensuring seamless injection into existing natural gas infrastructure. In the downstream sector, there is a focus on the development of new resources for RNG production from various organic waste

materials. The ideal goal is to develop scalable, economically viable RNG technologies that can seamlessly integrate into the natural gas industry, reducing its overall carbon footprint and contributing to global sustainability efforts.

The following are guided measures for submitting innovations for this technology class. Innovations do not need to meet the criteria at the time of application. Priority will be given to innovations that can demonstrate their current state and a plan to progress toward achieving the target criteria.

1. **Performance and Cost Efficiency:** Technologies must demonstrate significant improvements over existing biogas upgrading and RNG injection systems in terms of efficiency and cost-effectiveness. This includes a reduction in capital expenses (CAPEX) and operating expenses (OPEX) and an increase in biogas conversion efficiency.
2. **RNG Quality**: Technologies should produce RNG that meets or exceeds pipeline-quality standards, ensuring compatibility with existing natural gas infrastructure.
3. **Environmental and Safety Impact:** Technologies should have minimal environmental impact, with no adverse safety implications.
4. **Integration with Existing Operations**: Technologies should seamlessly integrate with current natural gas infrastructure and operations, offering beneficial synergies.

Areas of Interest

Biogas Upgrading

- **Pressure Swing Adsorption (PSA):** Advanced PSA systems for efficient biogas purification.
- **Membrane Separation:** Innovative membrane technologies for separating CO2 from biogas.
- **Cryogenic Separation:** Cryogenic processes for biogas purification.
- **Chemical Scrubbing:** Advanced chemical scrubbing systems for biogas upgrading.
- **Metal Organic Frameworks:** Employing MOFs to separate methane and carbon dioxide
- **Siloxane and VOC Removal:** Innovations outside of activated carbon and chillers

RNG Injection

- **Gas Quality Sensors:** High-precision and fast response sensors for ensuring RNG meets quality standards.
- **Pressure Regulation Systems**: Technologies for maintaining optimal pressure during RNG injection, Dynamic pressure regulation solutions consisting of better ways of modulating distribution and intermediate pressure regimes to work around demand fluctuation.
- **Real-time Monitoring Systems:** Real-time systems for monitoring and managing RNG injection into the grid.

Biogas Production Development

- **Landfill Gas:** Technologies for capturing and upgrading landfill gas to RNG, reduce air infiltration, methane leakage to the atmosphere, and to identify optimal locations for installing gas capture wells.
- **Anaerobic Digesters:** Improvements to microbial stability and resiliency during digestion or technologies/approaches that can increase biogas production from anaerobic digestion.
- **Wastewater Treatment:** Solutions for producing RNG from biogas generated at wastewater treatment facilities. Technologies that can remove "forever" chemicals from wastewater are also of interest.
- **Intermediate storage:** Processes to store liquid intermediates such as short-chain fatty acids to time-shift the production of biogas.
- **Reduction in heating emissions**: Technologies to reduce ambient heat loss from anaerobic digesters or to cost effectively heat digesters with electricity.

Feedstock/Digestate

- **Poultry manure:** Technologies that can reduce or adapt to high ammonia content in poultry manure.
- **Yard waste:** Technologies that can improve the breakdown of high-lignin containing yard wastes in municipal anaerobic digestion.
- **Stabilized carbon:** Technologies that can use biochar to improve the efficiency of anaerobic digestion and retain stabilized carbon in digestate.

- **Nutrient removal:** technologies that can concentrate and dewater potassium, phosphorous, and nitrogen containing nutrients from digestate.
- **Cover crops:** Techniques and research into the use of cover crops as a feedstock for anaerobic digesters.
- **Marine biomass:** Technologies to use fish/seafood waste or biomass harvested from the ocean with high salt content.
- **Plastic and contaminant removal:** Technologies to efficiently and cheaply remove plastic and non-organic contamination in feedstock.
- **Municipal wood waste conversion:** technologies that can use clean municipal wood waste to produce syngas or a digestible slurry.

3. Open Category (TRL 6+)

Context

Beyond energy efficiency and emissions reduction, the natural gas industry faces a diverse array of operational, environmental, and safety challenges that require innovative solutions across the entire value chain. This Open Category recognizes that transformative innovations often extend beyond traditional focus areas, addressing critical needs in water management, resource recovery, leak detection, liquefied natural gas operations, and other emerging priorities. These technologies may not fit neatly within the first two categories but serve essential purposes for upstream production, midstream transportation and processing, and downstream distribution operations throughout Canada. From enhancing operational safety and reliability to improving resource utilization and environmental compliance, this category supports solutions that tackle the multifaceted challenges facing the natural gas sector. By embracing a broader innovation landscape, the Open Category aims to advance technologies that deliver measurable environmental and economic benefits while addressing the evolving technical demands of a sustainable natural gas industry.

Challenge Statement

The Open Category encompasses a broad range of innovations that address critical operational, environmental, and safety challenges across the natural gas value chain. The following areas represent priority technologies, though applicants with solutions outside these examples are encouraged to apply if their innovation demonstrates measurable impact on emissions reduction, operational efficiency, safety improvement, or environmental performance in the Canadian natural gas industry.

Note to Applicants: These examples are not exhaustive. If your solution addresses challenges or opportunities in the Canadian natural gas industry (whether through emissions reduction, efficiency improvement, safety enhancement, environmental performance, or operational innovation) and does not fit neatly within the first two categories above, you are still strongly encouraged to apply. The Open Category is designed to support transformative technologies that deliver measurable impact across the natural gas value chain.

Areas of Interest (non-exhaustive list)

3.1 Pyrolysis Technologies

- Thermal decomposition systems for converting hydrocarbon waste into valuable products

- Methane pyrolysis for hydrogen production with solid carbon co-products
- Advanced reactor designs for improved conversion efficiency and product quality
- Integrated pyrolysis systems for waste-to-energy or waste-to-value applications
- Scalable solutions for remote or distributed deployment

3.2 Water Management

Technologies addressing water storage, overland transport, and treatment across upstream, midstream, and downstream operations:

- Advanced water treatment systems capable of removing oil carryover, diverse bacteria, iron, chlorides, and polyacrylamides at costs ideally around $\$5/m^3$ and not exceeding $\$20/m^3$
- Treatment solutions for hydrogen sulfide (H_2S), total suspended solids (TSS), and total dissolved solids (TDS)
- Scalable, skid-mounted systems rated for Class 1, Division 2 hazardous locations suitable for high-volume water processing
- Produced water treatment and reuse technologies
- Water recovery and recycling systems that reduce freshwater consumption and disposal costs

3.3 Multiphase Leak Detection and Flow Measurement

- Advanced leak detection technologies for gas and liquid hydrocarbons with improved sensitivity, accuracy, and response time
- Multiphase flow measurement systems that accurately calculate flow rates and concentrations of gas and liquid phases in compliance with Alberta Energy Regulator Directive 17 or equivalent standards
- Remote sensing and monitoring technologies for pipeline integrity and early leak detection
- Continuous monitoring systems for fugitive emissions identification and quantification
- Real-time detection systems with reduced false positive rates

3.4 Fuel Switching and Electrification

- Technologies enabling cost-effective fuel switching from diesel or propane to natural gas in industrial and commercial applications, aligned with Clean Fuel Regulation requirements
- Electrification solutions for natural gas operations that reduce reliance on combustion-based systems
- Innovations that reduce electricity transmission and distribution costs or improve power line efficiency
- Demand-side management technologies that optimize electricity consumption in electrified natural gas operations
- Hybrid electric-natural gas systems for operational flexibility

3.5 Natural Gas Road Transportation

- Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) vehicle technologies
- Advanced fueling infrastructure for CNG/LNG distribution
- On-site liquefaction or compression systems for fleet applications
- Heavy-duty vehicle conversions and engine technologies optimized for natural gas
- Cold chain logistics solutions utilizing LNG or natural gas

3.6 Energy & Thermal Storage

- Thermal energy storage systems for load shifting and waste heat utilization
- Compressed natural gas storage innovations for peak shaving and grid balancing
- Cryogenic energy storage leveraging LNG infrastructure
- Hybrid storage systems integrating thermal and electrical storage capabilities
- Seasonal energy storage solutions for remote or off-grid applications

3.7 LNG-Related Innovations

- Small-scale and modular LNG production technologies
- Advanced liquefaction systems with improved energy efficiency
- Boil-off gas management and recovery technologies
- LNG transportation, storage, and regasification innovations

- Cold energy utilization from LNG regasification processes

3.8 Value-Added Products

- Technologies converting natural gas or natural gas byproducts into high-value chemicals (e.g., methanol, ammonia, hydrogen)
- Carbon-to-value pathways utilizing captured CO_2 or methane
- Advanced catalytic processes for direct methane conversion
- Modular or distributed production systems for chemical synthesis
- Integration of natural gas resources with circular economy principles

3.9 Digital Solutions (AI & Software)

- Artificial intelligence and machine learning platforms for predictive maintenance and asset optimization
- Advanced analytics for operational efficiency improvements across production, transmission, and distribution
- Digital twins and simulation tools for process optimization and scenario planning
- Automated monitoring and control systems that enhance safety and reduce emissions
- Data integration platforms that improve decision-making and resource management

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