

NATURAL GAS



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Clean
Energy
Research
Centre

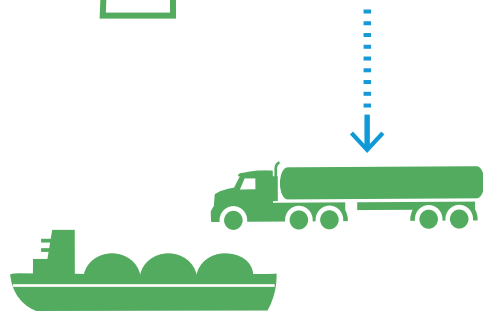
THE NATURAL GAS SECTOR AT CERC

Canada is uniquely positioned to become a global provider of clean energy solutions to enable a low-carbon economy. Research at Clean Energy Research Centre (CERC) covers the full value chain of natural gas fuels:



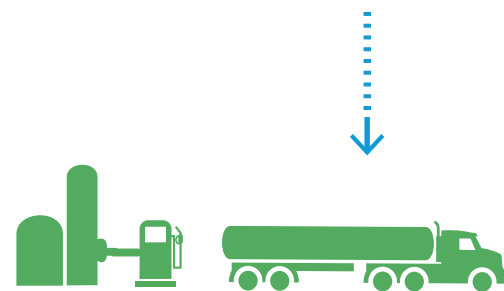
PRODUCTION AND DISTRIBUTION

Production and distribution systems must be economical across many scales. We are developing novel liquefaction technologies and infrastructure models for optimised supply chains.



STORAGE AND REFUELLING

Storage and refuelling systems are the source of significant cost, complexity and emissions. We are developing models, simulations, and experimental platforms for liquefied natural gas (LNG) during storage, transfer, and distribution.



END USE

Conversion of natural gas into useful energy must be efficient and with minimized emissions. We are developing the next-generation of engine and combustion systems for blended dual fuel combustion, dedicated natural gas engines and emissions catalysis.



POLICY AND DECISION SUPPORT

Underpinning any responsible alternative fuel adoption is the complete lifecycle assessment of its impact, including greenhouse gas emissions. Our research focuses on economic and emissions modelling of distribution options with complete business case assessment, and decision analysis.

SAFE, EFFICIENT, AND SUSTAINABLE NATURAL GAS

CERC aims to provide reliable evidence-based recommendations and technology solutions for the safe and environmentally responsible use of natural gas fuel to achieve:

- Increased safety, automation and ease of use to match or exceed the equivalent current petroleum processes
- Simplification and cost reduction of systems and equipment to improve the business case
- Largest possible GHG benefits through a drive towards zero methane venting through the entire value chain
- Broader NG fuels education of public and users
- Regulations and standards that are fit for purpose
- Better integration of Renewable Natural Gas (RNG)
- Net-zero carbon emissions building solutions

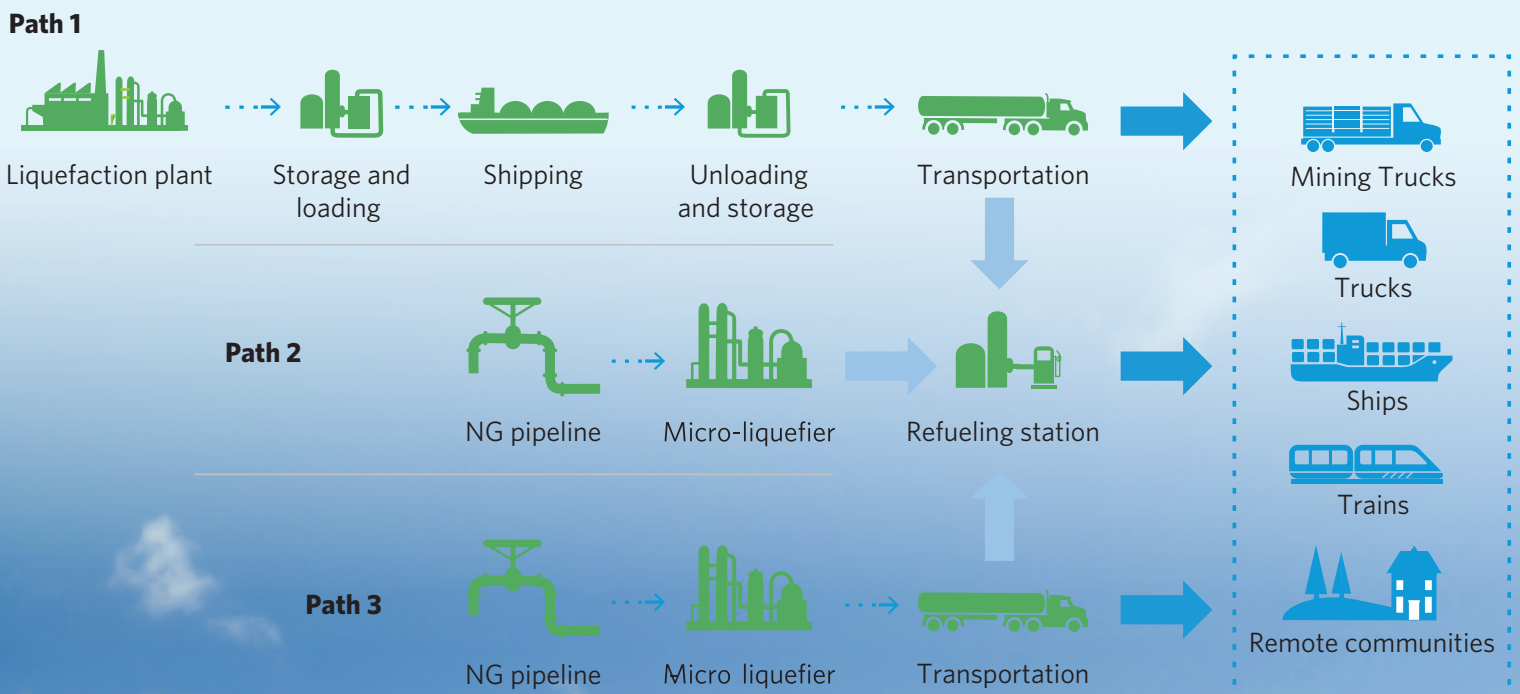
CHALLENGES AND OPPORTUNITIES

The announcements at the 21st Conference of Parties (COP) in Paris indicate that keeping global warming below 2°C above pre-industrial levels would require immediate and significant changes over the next three decades (as opposed to changes occurring over centuries). Natural gas has been proposed as a low-carbon fuel for many years. However, the emission of fugitive methane (a powerful greenhouse gas in itself) has the potential to significantly erode these benefits unless properly managed.



NATURAL GAS FUTURES

CERC has established the Natural Gas Futures (NGF) industry-led applied research and education consortium to support the responsible use of natural gas. The consortium includes Canadian and international companies and research organizations engaged in the production, distribution, design, development and use of solutions for natural gas fuel (both LNG and CNG). The target applications include road transport, marine, mining, rail, net-zero buildings, industrial and remote community power. The consortium aims to establish Canada as a centre of excellence for clean energy research and technology supporting the responsible use of natural gas as a fuel around the world.



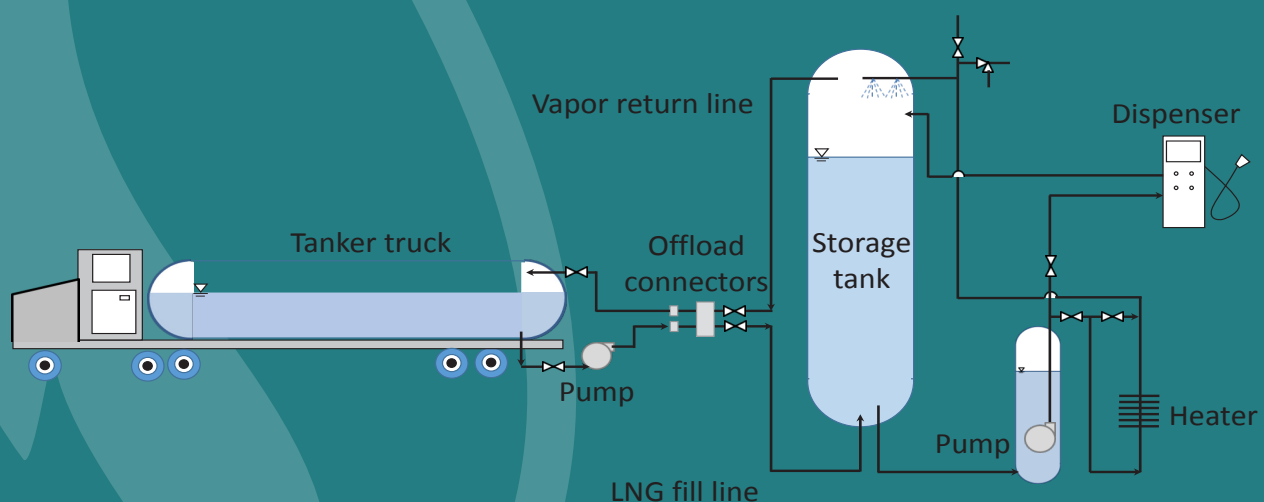
FEATURE PROJECT

THERMODYNAMIC ANALYSIS OF LIQUEFIED NATURAL GAS REFUELING STATIONS AND ONBOARD FUEL STORAGE TANKS FOR MOBILE APPLICATIONS

This research is focused on eliminating fugitive methane emissions from refuelling. LNG is stored at low temperatures (-162°C) and a small amount of heat added to the system causes the liquid to boil, creating boil-off gas and potentially releasing methane (a potent greenhouse gas).

The industry partners engaged in this project represent the full value chain from production and distribution (Fortis BC), integrated product solutions (Westport Fuel Systems) and end use applications (Seaspan Ferries). The project is supported by the Canadian Gas Association.

Through accurate thermodynamic modelling and simulation of the LNG distribution chain we are identifying sources of leakages and boil-off gas. The project aims to predict accurately the LNG properties as it moves from liquefier to tanker truck to fuel station and into the fuel tank of the ship or truck consuming the fuel. The model permits the assessment of state-of-the-art LNG refueling station technologies, refueling processes, and onboard fuel storage tanks.



THE CERC ADVANTAGE

The Natural Gas Futures Consortium comprises of a unique multi-disciplinary team of researchers across a number of major universities in Canada. Collaborating with CERC means:

EXPERTISE

Research areas accessible through our network of researchers include:

- Energy system modelling
- Complex systems design
- Chemistry
- Thermodynamics
- Computational fluid dynamics
- Combustion and emissions
- Economic and emissions modelling
- Lifecycle assessment

STRONG RELATIONSHIPS

Connections to a diverse group of government and industry partners help maximize both the relevance and impact of our efforts. Some of our partners include:

- Canadian Gas Association
- Fortis BC
- Westport
- Seaspan
- BC Ferries
- Port of Vancouver
- Canadian Natural Gas Vehicles Alliance

CERC RESEARCH APPROACH

BREAKTHROUGH TECHNOLOGIES

- Innovative microliquefaction, storage and insulation, sensors, controls and automation
- Game changers

SYSTEM SIMULATION MODELLING

- Modelling and simulation: economics, thermodynamics, CFD, FEa, etc.
- Validates technological benefits

PARTNERSHIPS + NEW VENTURES

- Commercialisation of research product(s)
- Work with existing partner companies, new start-ups, and licensing

EXPERIMENTATION + TESTING

- Bench and lab scale experiments
- Full-scale testing capabilities under development



THE UNIVERSITY OF BRITISH COLUMBIA
Clean Energy Research Centre



Clean Energy Research Centre (CERC)
Natural Gas
+1 604 822 4189
www.cerc.ubc.ca