Government of
Northwest Territories

Mackenzie Delta Liquefied Natural Gas (MDLNG)

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English

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French

Kīspin ki nitawihtīn ē nīhīyawihk ōma ācimōwin, tipwāsinān.
Cree

Tłı̨chǫ yatı k'ę̀ę̀. Dı wegodı newǫ dè, gots'o gonede.
Tłı̨chǫ

ʔerıhtł'ís Dëne Sųłıné yatı t'a huts'elkër xa beyáyatı theʔą ʔat'e, nuwe ts'ën yółtı.
Chipewyan

Edı gondı dehgáh got'ı̨e zhatıé k'ę́ę́ edatł'éh enahddhę nıde naxets'é edahłí.
South Slavey

K'áhshó got'ı̨ne xǝdǝ k'é hederı ʔedı̨htl'é yerınıwę nídé dúle.
North Slavey

Jii gwandak izhii ginjìk vat'atr'ijąhch'uu zhit yinohthan jì', diits'àt ginohkhìi.
Gwich'in

Uvanittuaq ilitchurisukupku Inuvialuktun, ququaqluta.
Inuvialuktun

ᑖᒃᑯᐊ ᑎᑎᕋᖅᑲᐃᑦ ᐱᔪᒪᒍᕕᒋᑦ ᐃᓄᒃᑎᑐᓕᕐᓯᒪᓗᑎᒃ, ᐅᕙᑦᑎᓐᓄᑦ ᐅᖄᓚᔪᓐᓇᖅᑐᑎᑦ.
Inuktitut

Hapkua titiqqat pijumagupkit Inuinnaqtun, uvaptinnut hivajarlutit.
Inuinnaqtun

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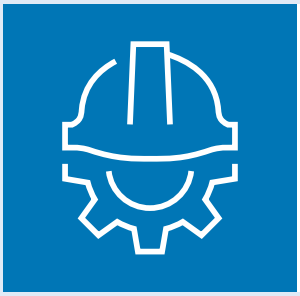
Overview



Natural gas in in the Inuvialuit Settlement Region (ISR) is substantial in quantity and quality and has long been recognized as a possible alternative energy for regional and even global markets.

The region's well-defined petroleum resources have never been in question. For more than 50 years, some of the world's largest oil and gas companies have invested hundreds of millions of dollars to explore for oil and gas in the Mackenzie Delta.

In 2021 the Government of the Northwest Territories (GNWT) contracted a pre-feasibility study (the Study) to determine if it would be viable to process natural gas from the onshore Mackenzie Delta and transport it for sale to international markets.

The completion of this Study is itemized in the Mandate of the Government of the Northwest Territories 2019-2023 and is an action item in the Department of Industry Tourism and Investment (ITI)'s ongoing implementation of the NWT Petroleum Resources Strategy.

The Study, which also underwent an independent, confidential third-party review conducted by Poten and Partners in 2022, was funded by both the GNWT and the Canadian Northern Economic Development Agency (CanNor).

It concluded that the responsible development and export of Mackenzie Delta Liquefied Natural Gas (MDLNG) has enough merit to, at least, warrant a full study. It will be up to interested industry investors to take this next step.

Coal has long been an energy source in markets such as East Asia however, many nations are now prioritizing natural gas as a transitional fuel to help curtail local and global greenhouse gas emissions and improve air quality and human health in their cities.

With the global market demand for LNG projected to grow, analysts believe new LNG production will be required as soon as 2026 to meet the anticipated demand.

Energy analysts have predicted that Asia-Pacific demand alone for natural gas will increase from 835 billion cubic meters in 2019 to more than 1,660 billion cubic meters by 2050. It is projected that Asia-Pacific nations will represent more than 80 percent of the global market share for LNG by 2035.

Around the world, jurisdictions are already promoting and developing their own LNG projects with a view to filling the forecasted future global supply gap.

The GNWT's pre-feasibility study supports the idea that NWT gas could meet some of the demand. Additionally, investments on the scale required to develop and export LNG from the Mackenzie Delta would provide an unprecedented stimulus for the NWT's economy.

> *The export of Mackenzie Delta LNG represents an opportunity for long-lasting partnerships in the region, with development driven by Inuvialuit priorities and subject to environmental approvals identified in the Inuvialuit Final Agreement.*

If the economic potential of MDLNG is ever to be realized, this may be the window of time in which to act.

Mackenzie Delta natural gas, while publicly owned and under licenses held by oil and gas companies, is entirely located within the Inuvialuit Settlement Region and would only move with Inuvialuit support, in whatever form that takes. The export of MDLNG represents an opportunity for long-lasting partnerships in the region, with development driven by Inuvialuit priorities and subject to environmental approvals identified in the Inuvialuit Final Agreement.

An export project would further assert Canada's Arctic sovereignty and give international investors a compelling Northern option as they look to diversify their energy portfolios by backing developments with high Environmental, Social and Governance (ESG) standards in jurisdictions with robust regulatory regimes. GNWT recognizes both the need to reduce greenhouse gas emissions and support a thriving economy, and such a project would need to fit within this context.

Regardless of its outcomes, a full feasibility study would, in itself, provide research investment, jobs, and economic development opportunities for the region.

How would such a project be feasible? Why would anybody buy NWT gas? What about Climate Change? This document is intended to address some of these initial questions that you may have.

The MDLNG Pre-feasibility Study

The GNWT commissioned a pre-feasibility study (the Study) in 2019 to determine if large-scale natural gas liquefication and export was either technically possible or financially viable. In a nutshell, the development of MDLNG would involve extracting proven, conventional onshore reserves of natural gas, liquefying them for transport and then exporting them by ship to target markets in Asia or elsewhere.

The Study, completed in April 2021 by Advisian, concluded that it was not only technically possible using proven and commercialized technologies, but also economically competitive against other current Canadian and international LNG export projects.

For the Study, a scenario of four million tonnes of natural gas produced annually in the NWT was modeled and assessed with an internal rate of return of roughly 10 percent, based on 2021 costing. Estimated existing reserves would allow the NWT to maintain this level of production for at least 20 years. As other resources are discovered or become available, this concept could be expanded—both in terms of annual production and overall life of production. As additional production is introduced using existing infrastructure from the initial capital investment, profitability would also grow.

> *[MDLNG is] not only technically possible using proven and commercialized technologies, but also economically competitive against other current Canadian and international LNG export projects.*

In the Study's export scenario, natural gas is extracted from a series of previously discovered and proven fields west and south-west of Tuktoyaktuk, moved to a central processing facility and then to an offshore liquefaction and loading facility. From there, the model uses icebreaking LNG tankers to ship the product to LNG-importing nations in Asia. Production facilities and associated infrastructure modelled in the Study have been operating safely in Arctic climates like Alaska and Russia for more than 40 years.

Thanks to past exploration work conducted by resource companies, the Mackenzie Delta region hosts a discovered natural gas resource of nearly eight trillion cubic feet (Tcf), with an expected additional potential undiscovered resource of 11.1 Tcf. Figures and estimates used in the Study come from estimates made by oil and gas companies and the National Energy Board as part of their research to advance the now-abandoned Mackenzie Gas Project.

Four separate fields, located to the west and south-west of Tuktoyaktuk, would be the primary sources of natural gas. During the initial phase of the concept, the Taglu, Umiak and Niglintgak fields would actively feed the export scenario. Roughly a decade later, the Parsons Lake field is modeled to come onstream, with the potential for other fields soon after, based on exploration work that would be stimulated by the project.

Natural gas from each field would travel to a central gas processing facility to ensure it meets specifications for liquefaction and loading via a gravity-based structure (GBS) located roughly 30 kilometers offshore in the Beaufort Sea. The processing facility in the scenario would process 650 million cubic feet of natural gas per day and be designed to allow for CO_2 capture and storage.

At the offshore GBS loading facility the natural gas would be liquefied and stored for transportation. Similar offshore liquefaction and loading processes and facilities are in use around the globe in countries such as Malaysia, Russia and Australia, although the unique conditions of the Beaufort Sea and anticipated climate change impacts would need to be factored into the GBS facility design.

Polar-class LNG carriers, designed to navigate safely in difficult ice conditions and on long open-water voyages, would make roughly 50 shipments to Asia per year. The remote Yamal peninsula in Siberia is currently home to the first commercial use of this icebreaking LNG tanker technology, which could define the future for LNG shipping in Canada's Arctic. With reinforced hulls and more nimble controls to navigate the complexities of the Arctic's ice conditions, these tankers have been running at

AT A GLANCE: MDLNG PRE-FEASIBILITY STUDY

4M	20+	170k	50
tonnes of natural gas annually	years of production	cubic metres per shipment	shipments annually

full capacity from Yamal to Tokyo since 2018. Each of the five ice-breaking LNG carriers considered in the Study's export scenario would operate year-round carrying roughly 170,000 cubic metres of LNG per shipment.

The gas deposits modeled in the Study are all publicly owned, with the significant discovery licenses held by individual companies. Niglintgak, held by Shell, is located 85 kilometers west of Tuktoyaktuk. This field contains roughly 0.912 Tcf of discovered natural gas. Umiak, held by MGM Energy Corp. and located 40 kilometers west of Tuktoyaktuk, contains roughly 0.525 Tcf of discovered natural gas.

Taglu, held by Imperial Oil, is located 70 kilometers west of Tuktoyaktuk. This field contains roughly 2.898 Tcf of discovered natural gas, making it the largest source of gas in this MDLNG scenario. Gas from Taglu and from the other fields, would be processed before moving by pipeline (built 64.8 kilometers onshore and 30.8 kilometers offshore) to the loading facility.

Parsons Lake, southwest of Tuktoyaktuk, is held by Conoco Phillips and ExxonMobil. This field contains roughly 2.257 Tcf of natural gas. Under the scenario outlined in the Study, gas from this field would be transported by gathering pipeline to the CGPF at Taglu roughly 10 years after production first begins.

Other gas fields in the region, such as MGM's Langley, Olivier, and Ellice fields, have potential to come online later and contain an already-discovered natural gas resource of 1.365 Tcf.

Respecting Climate Change and the Environment

As a signatory to the Paris Agreement, the federal government is taking steps to reduce CO_2 emissions in Canada. This has included increasing its emissions reduction target to 40-45 percent below 2005 levels by 2030 and passing the *Canadian Net-Zero Emissions Accountability Act* committing Canada to achieving net-zero emissions by 2050.

Net-zero refers to a project or a jurisdiction that either releases zero greenhouse gas emissions or offsets its emissions to realize no net emissions.

The GNWT is currently committed to the 2016 Pan-Canadian Framework target to achieve a 30 percent reduction in CO_2 emissions by 2030.

The *NWT Climate Change Strategic Framework* outlines the GNWT's response to climate change concerns while the *2030 Energy Strategy* outlines the GNWT's approach to supporting secure, affordable, and sustainable energy. The NWT Carbon Tax will increase annually to reach $170 per tonne by 2030.

Given the NWT's reliance on imported fossil fuels (85 percent), almost all (or approximately 95 percent) of the NWT's anthropogenic emissions are energy related. The NWT's current emissions reduction target, set out in both the *NWT Climate Change Strategic Framework* and the *2030 Energy Strategy*, equates to annual emissions of 1,094 kilotonnes (kt) carbon dioxide equivalent (CO_2e).

As of 2021, the latest year for which data is available, the NWT's total annual anthropogenic emissions were 1,287 kt CO_2e, a 25 percent decrease when compared with 2005 levels.

The GNWT is conducting public engagement activities to explore what emission-reduction scenarios and the resulting low-carbon pathways might look like for the future of the NWT. This input will help shape policy decisions moving forward, including whether the GNWT should update its 2030 emissions target and/or set a longer-term emissions reduction target to 2050.

In the examination of the MDLNG export scenario, the prefeasibility study takes the commitment to global emissions reductions into consideration and includes analysis of opportunities to decarbonize MDLNG production by using renewable energy sources to power onsite processes or incorporate carbon sequestration.

Geologic carbon sequestration is one of several methods used to reduce or eliminate a project's carbon dioxide (CO_2) emissions. The emissions are captured from the air or direct from their source and processed, to eliminate water molecules among other impurities, before being trapped in identified stable underground geologic formations indefinitely.

Of course, any natural gas development in the NWT will also need to be sensitive to the region's ecosystem. Facilities and gathering pipelines would be designed to have the least impact possible on the permafrost and the environment around them and be safe and resilient in the face of climate change impacts in the Mackenzie Delta region.

The model used by the Study sees multiple production wells drilled directionally from well pads built on elevated pile foundations to help keep the ground frozen. Meanwhile, above-ground flow lines would be insulated, and the processing facility built in a way that protects the permafrost.

The Challenge of Net Zero

The prefeasibility study commissioned by the GNWT contemplates a potential project life of 2030 to 2054.

Given Canada's commitment to achieve net-zero emissions by 2050, and the need for future Canadian LNG projects to meet these guidelines, any MDLNG scenario will need to consider, not only available technologies and best environmental practices by 2050, but also align with Canada's net-zero target.

Identifying ways to address carbon emissions resulting from natural gas development will be key to both attracting investment and solidifying government and community support.

The central gas processing facility envisioned in the Study will be designed to allow CO_2 capture and storage. Meanwhile, the GNWT is working to identify an immediate geological formation in which to store captured CO_2 to further improve the concept's economics by reducing carbon emissions subject to taxation.

As it sits, the Study assumes the use of best available technologies and the use of depleted natural gas reservoirs to incorporate carbon capture and sequestration beginning in Year 10 of the MDLNG scenario.

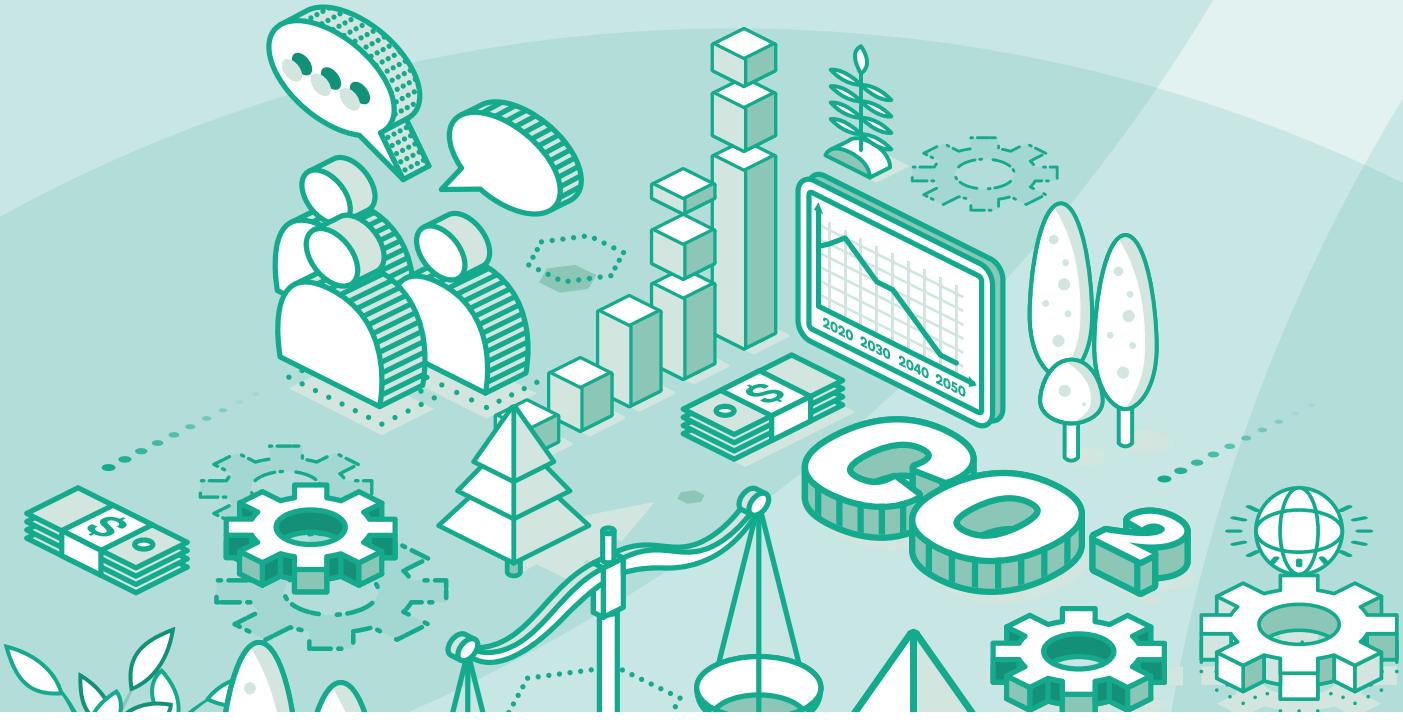
Identifying ways to address carbon emissions resulting from natural gas development will be key to both attracting investment and solidifying government and community support.

While the NWT's annual emissions would increase between 2030 and 2040, MDLNG would contribute to reduced global emissions. With the implementation of carbon capture and sequestration in 2040, the project would be able to maintain ultra-low to net-zero emissions for the remainder of its operation.

As the economies of Asian countries continue to grow, so too will their demand and consumption of energy. LNG's lower and cleaner emissions compared to coal make a strong environmental case for further research into the potential MDLNG project.

For the base case MDLNG scenario presented in the Study, the total annual greenhouse gas emissions are estimated at about 1,750 kt CO_2e per year, due mostly to the on-shore production of natural gas and the off-shore compression to produce LNG. For context, this is roughly 135 percent more than the NWT's current total annual emissions of 1,287 kt CO_2e.

However, when used to produce energy, natural gas generates roughly half the CO_2 emissions of coal, without the harmful emissions of carbon monoxide, sulfur, mercury, cadmium and arsenic. If developed, MDLNG would help reduce global greenhouse gas emissions by supplanting existing and anticipated use of coal and high emission fuels.



MDLNG's Competitive Edge

Compared to LNG export developments in B.C., on the U.S. Gulf Coast and in Mozambique, the GNWT's prefeasibility study concludes that it would cost less per ton to supply markets in Asia with LNG from the Mackenzie Delta.

At the outset, such a project may sound extraordinary, but the opportunity exists, and an NWT project would have unique advantages that would set it apart from most other domestic and global LNG export projects.

First, the Mackenzie Delta is closer to Asia Pacific markets than any other jurisdiction. An "over-the-top" shipping route from the NWT to Tokyo, Japan is 3,836 nautical miles, 464 nautical miles closer to the Japanese port than Vancouver, B.C. The distance from Yamal, an Arctic natural gas region in Russia, to Tokyo is more than 5,150 nautical miles. In fact, the Mackenzie Delta is significantly closer to Asian ports than B.C., the Gulf of Mexico or Russia's Arctic Coast and it would mean significantly cheaper transportation costs for potential buyers.

Many of Canada's major LNG developments are reliant on pipelines to connect export infrastructure with gas resources. These mega-pipelines are expensive and complicated to construct, both technically and politically. The MDLNG export scenario would only require a local pipeline network

MDLNG IS CLOSER THAN YOU THINK

Approximate shipping distances in nautical miles to Tokyo, Japan.

3,836
from Mackenzie Delta, NWT

4,300
from Vancouver, British Columbia

5,150
from Yamal, Russia

due to the proximity of the gas fields to the coast, further reducing costs and regulatory challenges.

A strength of the MDLNG concept opportunity today stems, in part, from the regulatory work that came before it on the Mackenzie Gas Project (MGP). The completed Environmental Assessment of that initiative will be relevant to much of the MDLNG. The visioning and planning that brought NWT governments together in support of the MGP remains foundational to the relationships that are in place today.

LNG is environmentally safe to ship. Natural gas is cooled to-162° Celsius to convert it to a liquid form and, if released, simply evaporates. “Bunker” fuel is not used for shipping LNG, as the ship uses a small part of its own LNG cargo to fuel its journey.

Mackenzie Delta gas resources are also particularly attractive to potential producers. There is no need to incorporate hydraulic fracturing in the Mackenzie Delta. The resource exists exclusively in conventional geologic reservoirs and is sweet gas (as opposed to sour gas which has sulfur in it). For producers, this means less drilling and processing compared to other natural gas deposits and a further reduction in both costs and environmental impacts for any development.

Finally, today’s global energy investors are seeking projects that have strong Environment, Social and Governance (ESG) standards. The natural gas in the Mackenzie Delta is located entirely within the Inuvialuit Settlement Region and the potential for Inuvialuit partnership and local economic development cannot be overstated.

In addition to the federal Impact Assessment Act, any project would be subject to the Inuvialuit co-governance, environmental assessment and regulatory regime established through the Inuvialuit Final Agreement. There are few potential global investments subject to this standard of regulatory governance which makes the MDLNG project an attractive opportunity for international companies and investors looking to diversify their energy portfolios by supporting new, Indigenous-led energy developments in safe and environmentally and socially responsible jurisdictions.

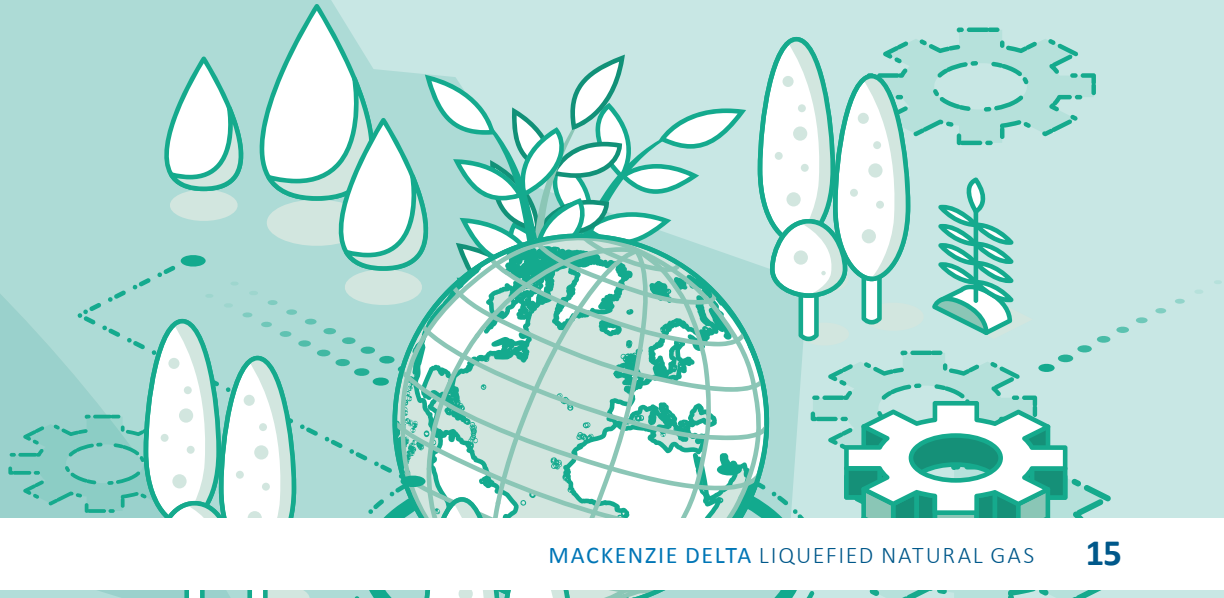
Conclusion

There is a large economic opportunity in Mackenzie Delta Liquefied Natural Gas.

It is based on preliminary financials and environmental planning, and a confluence of global and political factors—from growing LNG demand due to the worldwide effort to reduce carbon emissions, to a desire by investors to back developments in stable, low-risk jurisdictions with high ESG standards.

The NWT has built a reputation for broad political and social will to see natural resource projects through to completion and the GNWT has demonstrated its ability to work with the federal government and Indigenous governments across the territory to support natural resource projects.

This document is not intended to support or advance a specific LNG project, but to provide context for the GNWT's prefeasibility study and its data and awareness among NWT residents and industry of the potential that exists in advancing liquefied natural gas from the Mackenzie Delta to international markets needing this energy alternative.



Mackenzie Delta Liquefied Natural Gas

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