LOOKING TO ALASKA

Around the world, people and nations are working to replace high-emission energy sources with lower-emission alternatives. This activity reflects growing interest in reducing the collective environmental footprint while preserving access to reliable and affordable energy.

Additional investments in infrastructure and new technologies are required to provide generation, storage, and transmission capacity for peak and growing energy demands across a variety of fuel sources. Today, and for the foreseeable future, emerging energy alternatives such as wind and solar are not able to adequately meet the world's needs, particularly during peak demand times. Natural gas will remain an instrumental source of dependable energy and an advantageous way to minimise climate impact for decades to come.

Timothy Fitzpatrick, Alaska AGDC, US, looks at how the Alaska LNG Project could minimise the impact on the climate, specifically in relation to its greenhouse gas lifecycle.

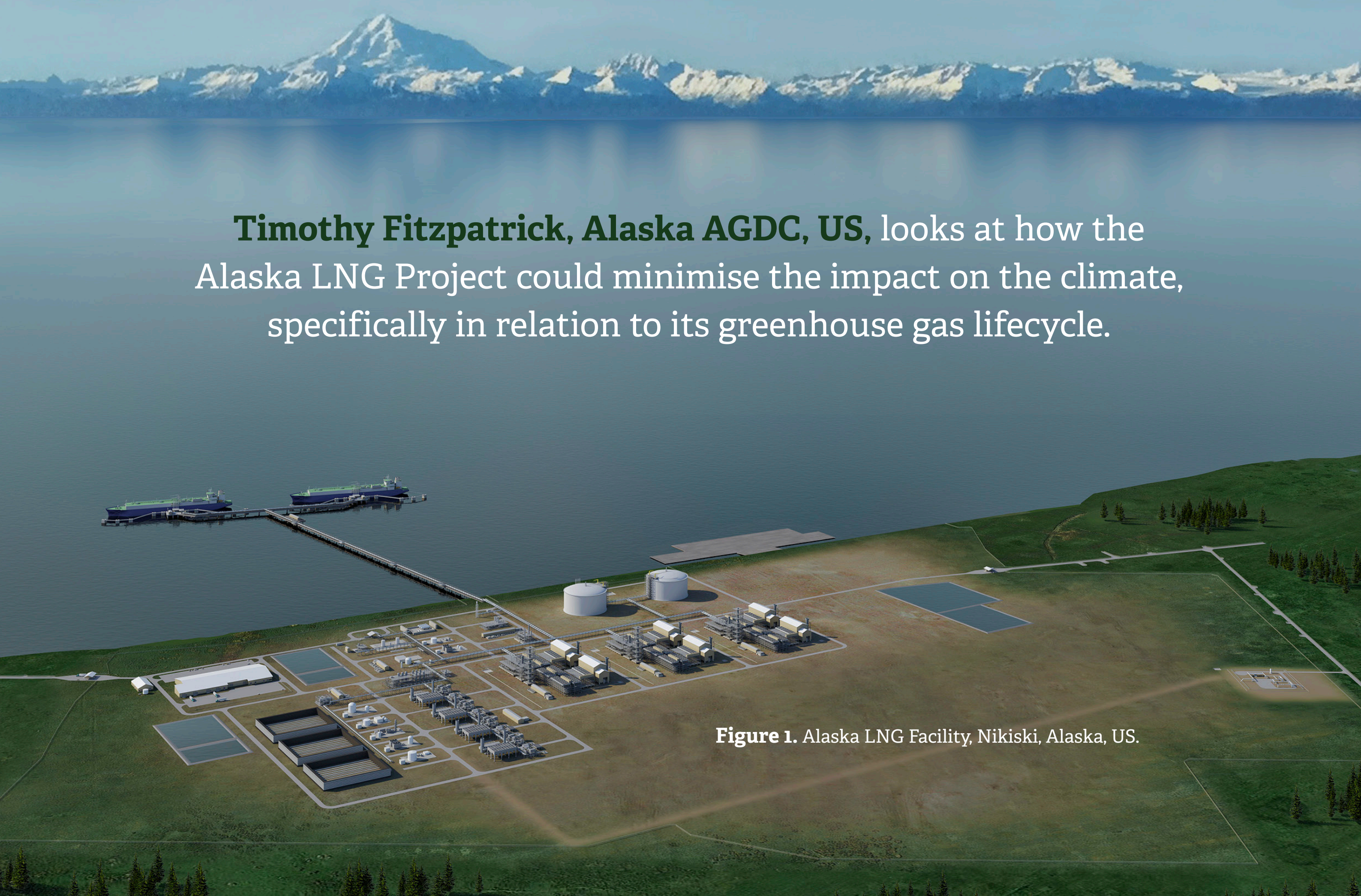

Figure 1. Alaska LNG Facility, Nikiski, Alaska, US.

As policy-makers, energy companies, and investors evaluate the benefits and costs of individual energy projects, the overall mix of energy sources will evolve. Energy projects are beginning to quantify climate benefits along with more established metrics such as cost, longevity, and reliability. Quantifying climate benefits alongside other measures provides another advantage for natural gas when compared to alternatives.

Frank Richards, President of the Alaska Gasline Development Corporation, which is developing the Alaska LNG Project, said: "The commercial and economic development benefits from completing Alaska LNG are compelling and well known. This new report documents for the market and policy-makers alike the significant environmental improvements that Alaska LNG will deliver."

The recently published report 'Greenhouse Gas Lifecycle Assessment: Alaska LNG Project' is an example of how energy projects are adding climate benefits to the checklist of distinguishing features to differentiate preferable projects from other alternatives.[1]

Alaska Governor Mike Dunleavy hailed the report's publication, noting that "Alaska has some of the world's strictest environmental laws, and Alaska natural gas should be a key component of any realistic energy roadmap to a cleaner climate. This report documents the substantial climate benefits that clean-burning Alaska natural gas has for our environment here at home and around the world."

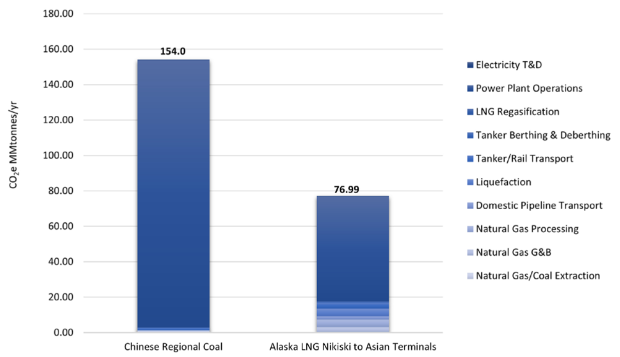

Figure 2. Chinese coal comparison to Alaska LNG natural gas GHG emissions.

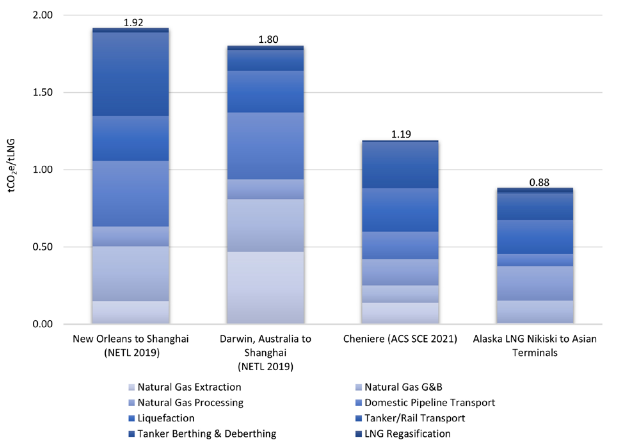

Figure 3. Natural gas lifecycle GHG intensities production through regasification.

Background

Richards explains that the US$38.7 billion Alaska LNG project "is being developed to commercialise Alaska's vast North Slope natural gas reserves by finally building the necessary infrastructure to utilise this stranded asset for in-state and export customers."

Principal project components include a North Slope-based gas treatment facility, an approximately 800-mile pipeline, and an LNG plant at tidewater in Southcentral Alaska. When completed, Alaska LNG will provide gas for in-state use and export 20 million tpy to nearby Asian markets, many of which are working to replace high-emission, coal-generated energy with cleaner-burning natural gas.

Alaska LNG received federal authorisation to construct and operate the project from the Federal Energy Regulatory Commission (FERC) in 2020. FERC authorisation followed publication of the project's final Environmental Impact Statement (EIS). Richards points out the comprehensive nature of FERC's environmental review, which analysed more than 150 000 pages of scientific data and encompassed the project's potential environmental impacts and the measures used to mitigate them.

In early 2021, following a change in administration, the US Department of Energy (DOE) initiated a supplemental EIS to further examine the environmental impacts of Alaska LNG. In order to define the project's potential greenhouse gas (GHG) impacts for the LNG marketplace and to anticipate DOE's analysis, Alaska LNG undertook the Greenhouse Gas Lifecycle Assessment (GHG LCA).

Results

The GHG LCA compares the environmental impact of Alaska LNG against an existing energy supply chain to document the potential benefits of Alaska LNG. The LCA assesses GHG emissions across the entire lifecycle of Alaska LNG based on project-specific and publicly available data. Doing so provides real-world comparable numbers for a fact-based, tangible discussion rather than the hyperbole which often surrounds hypothetical future energy ideas lacking specific project proposals, budgets, timelines, or regulatory approvals.

The report also provides data about the emissions impact from Alaska LNG which can be reviewed against peer LNG scenarios. This comparison "reinforces the conclusion that natural gas from Alaska LNG is a favourable source of energy from an environmental standpoint for the target Asian markets," according to Richards.

Alaska LNG natural gas vs Chinese coal power generation

While studies have repeatedly shown natural gas used for power generation significantly reduces (by 40 - 60%) GHG emissions when it replaces coal-fired power generation, market forces and variability in regulatory requirements continue to prompt construction of hundreds of new coal plants.

For example, approximately 58% of China's total energy consumption in 2019 came from coal. Although China accounts for 28% of total global annual carbon dioxide (CO_2) emissions according to the New York Times, China "is building the world's largest fleet of coal-fired power plants within its borders, and most of its electricity still comes from coal." In 2020, Chinese provinces granted construction approval for more than three times the coal power generation capacity permitted in 2019.

The good news, however, is that China is now also the world's leading importer of LNG and is using LNG to lower emissions and clear the air in some of China's most heavily polluted markets. Alaska's close proximity to Asia has enabled the state to develop close trading relationships with China and other Asian nations, and Asia is a natural target market for Alaska LNG.

Accordingly, the Alaska LNG GHG LCA compares emissions from Alaska LNG to those of a representative China regional coal supply chain system to assess GHG intensity differences and document the benefits of transitioning to natural gas.

The LCA finds that the total lifecycle GHG emissions for Alaska LNG natural gas is 50% less, or 77 million tpy of CO_2 equivalent (CO_2e), than Chinese regional coal for a comparable amount of power production. To put 77 million tpy of CO_2e into perspective, the US Environmental Protection Agency (EPA) provides an online GHG equivalencies calculator to translate "abstract measurements into concrete terms you can understand, such as the annual emissions from cars, households, or power plants."[2]

The EPA tool calculates that the annual emissions savings from replacing coal with Alaska LNG is the equivalent GHG savings of removing 16 745 953 passenger cars from the road, or eliminating the CO_2 emitted by 19.4 coal-fired power plants, or burning 8 664 341 172 gal. of gasoline. The EPA equivalency calculator also shows that Alaska LNG's GHG reductions are equal to the amount of carbon sequestered by 1 273 211 303 tree seedlings grown for 10 years or 94 338 668 acres of US forests in one year.

The 77 million t Alaska LNG CO_2e/y savings described in the LCA is calculated by comparing the total end-to-end GHG emissions from a representative Chinese regional coal supply chain to the equivalent comprehensive emissions from Alaska LNG. The complete list of components used to calculate emissions from the coal supply chain are: coal extraction, rail transport, power plant operations, and electricity transmission and distribution.

The equivalent Alaska LNG emissions calculation totals emissions from natural gas extraction, gathering and boosting, processing, pipeline transport, liquefaction, tanker transport, tanker berthing and deberthing, LNG regasification, powerplant operations, and electricity transmission and distribution.

The majority of GHG emissions in the LCA from both Alaska LNG and coal-based power generation is from the power generation process itself, which is a function of power plant efficiencies and the associated fuel types. For the Alaska LNG Project, power generation accounts for 77% of the total GHG emissions, whereas power generation from Chinese regional coal is approximately 98% of the total GHG emissions.

Alaska LNG natural gas vs other LNG projects

The data calculated in the Alaska LNG LCA also documents how LNG from Alaska LNG will have a materially smaller environmental impact when compared to LNG from other sources targeted to customers in the same region.

The US National Energy Technology Laboratory (NETL), part of the Department of Energy, has published emissions-related data for LNG delivered to Asia from the US Gulf Coast and from Australia. Additionally, Cheniere recently published an LCA for the Sabine Pass LNG project. These sources provide a comparative illustration of Alaska LNG's benefits.

To facilitate the comparison on an LNG-delivered basis, the NETL projects, the Cheniere LCA, and the Alaska LNG Project carbon intensities were converted to a standardised value of t of CO_2e/t of LNG (CO_2e t/t of LNG).

There are numerous reasons why the GHG intensity of the Alaska LNG Project is significantly lower than that of the two scenarios assessed by NETL and the Cheniere LNG project. Notable differences are attributed to the following:

- Natural gas produced from the Prudhoe Bay Unit and the Point Thompson Unit on Alaska's North Slope intended for Alaska LNG is associated gas that includes co-products of oil and water that share the extraction, gathering, and boosting facilities, and associated emissions. As such, the emissions associated with the natural gas production are smaller than for natural gas produced on a standalone basis.
- The NETL study examined natural gas from both conventional and unconventional sources. The unconventional gas (Appalachian shale gas shipped from New Orleans, US) has more wells and higher emissions from boosting than the Alaska LNG Project.
- The conventional gas (Darwin, Australia) in the NETL study lacks the environmental efficiencies gained with Alaska LNG because the Alaska natural gas shares processing with oil.
- The scenario in the NETL study scaled pipeline transport emissions based on multiple pipeline networks. Accordingly, the resulting modelled emissions are based on a representative pipeline transmission scenario of 600 miles of pipelines with 10.2 transmission stations typical of the infrastructure used to produce natural gas. Alaska LNG's design features a streamlined single 800-mile pipeline with only eight compressor stations, reflecting the concentrated North Slope reservoir, which results in lower fugitive and compression combustion emissions. The corresponding estimated GHG intensity benefit is less than Cheniere and NETL intensities by a factor of two and five, respectively.
- The Alaska LNG GHG intensity is lower than Cheniere for the natural gas extraction/production component. Natural gas extraction and production estimates are lower, likely due to the fact the Cheniere facilities have no co-produced oil and therefore lack the emissions efficiencies for the extraction and gathering and boosting facilities.
- LNG delivered to Asia originating from the US Gulf Coast generates significantly higher tanker emissions than LNG from Alaska due to the significantly longer ocean transportation distances. Each tanker round trip from the Gulf is approximately one month longer than from Alaska and includes additional potential bottlenecks because of the required Panama Canal crossing.

In-state climate benefits

Alaska, as host to the project, will for the first time have widespread access to natural gas when Alaska LNG is completed and benefit from the environmental advantages that natural gas brings.

Due to its vast size, remote landscape, and limited infrastructure, many Alaskans are forced to rely on wood or diesel fuel for heat and energy because they lack access to natural gas. Richards points out that "Residents of Fairbanks, Alaska, the state's second largest city, routinely suffer health problems associated with the resulting poor air quality, and the city has the unfortunate distinction of being named the American Lung Association's 'Most-Polluted City in the Nation'.[3] Alaska LNG will bring much-needed relief."

Methods

The LCA framework and approach were set up on an apples-to-apples basis to be consistent and comparable with recent LCAs completed by NETL, with project-specific modifications to represent the unique elements of the Alaska LNG Project's supply chain. Those elements include a contained supply basin operated in cold climate conditions using shared oil production facilities, a GTP that includes CO_2 byproduct separation and re-injection, a single transmission pipeline system, and favourable proximity to Asian LNG market destinations.

The framework presented in the Alaska LNG LCA uses DOE NETL methods in conjunction with actual carbon-based GHG emission information for upstream components, as published in EPA emissions reports, project-specific estimates for project components, and published estimates for downstream components consistent with the estimates used by the NETL for similar LCAs. The LCA also uses well-documented assumptions and methodologies consistent with other LCA studies, most notably those completed by NETL.

To complete the report, Alaska LNG representatives assembled a specialised team of independent third-party air quality, environmental, and energy experts from EXP, which provides engineering, architecture, design, and consulting services to the world's built and natural environments; SLR Consulting, a company specialising in environmental and advisory solutions helping clients achieve sustainability goals; and Ashworth Leininger Group, which offers air quality and environmental consulting services to a broad spectrum of clients. LNG

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