LNG Allies
THE US LNG ASSOCIATION

Comments on the DOE/NETL Study:

"Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States: 2019 Update"

Background

The National Energy Technology Laboratory (NETL) is one of 17 national laboratories managed by the U.S. Department of Energy (DOE). Among key NETL programs is "Energy Analysis" which conducts studies "that utilize a multi-disciplinary approach to assess large, complex energy systems encompassing energy production, distribution, and use."

NETL has developed one of the world's most advanced natural gas computer simulation models and NETL's Energy Analysis unit has used this model to conduct several meticulous Life Cycle Analyses (LCAs) of Greenhouse Gas (GHG) Emissions involving natural gas systems.[1] Included among the NETL body of work is a 2014 LCA study comparing the GHG impacts of U.S. liquefied natural gas (LNG) in Asian and European markets with locally produced coal and Russian pipeline gas.[2]

NETL's 2019 Update of the 2014 LNG LCA study was published in the *Federal Register* on Sept. 19, 2019, under the title: *Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States: 2019 Update*[3] (2019 Update). DOE's Office of Fossil Energy (FE) has requested interested parties to submit comments. ***LNG Allies is pleased to provide these comments supporting the conclusions reached in the 2019 Update.***

Discussion: Modelling Approaches, Parameters, and Assumptions

Unlike other LCA modelling efforts, the 2019 Update fully details: (1) the LCA approach used; (2) the modelling approach(es) taken; and (3) key modelling parameters. This complete transparency enables other interested parties to compare NETL's results to other, LCA investigations.

LNG Allies does not possess the technical expertise to comment knowledgeably on the approaches, parameters, or assumptions used by NETL. We do, however, note that the assumptions used in this study track closely with other, similar studies published in peer-reviewed journals such as *Environmental Science & Technology*. (See below.) We also suggest that anyone criticizing the approach employed by NETL—especially assumptions relating to the venting, flaring, and the inadvertent release of methane—must demonstrate specifically and convincingly how/where NETL has errored in its reasoning.

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[1] Life Cycle Analysis of Natural Gas, Extraction and Power Generation (NETL, May 2014). Life Cycle Analysis of Natural Gas Extraction and Power Generation (NETL, April 2019).

[2] Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States (NETL, May 2014).

[3] Life Cycle Greenhouse Gas Perspective on Exporting Liquefied Natural Gas from the United States: 2019 Update (NETL, Sept. 2019).

Discussion: Findings from Other Life Cycle Analyses

A literature search performed by LNG Allies reveals three relevant studies that have been published in *Environmental Science & Technology*, a peer-reviewed journal of the American Chemical Society:

1. Abrahams, L. S.; Samaras; Griffin, M. W.; Matthews, S. H. *Life Cycle Greenhouse Gas Emissions From U.S. Liquefied Natural Gas Exports: Implications for End Uses.* Environ. Sci. Technol. 2015, 49, 3237-3245. [Hereinafter "Abrahams, 2015"]
2. Kasumu, A.S.; Li, V.; Coleman, J.W.; Liendo, J.; Jordaan, S.M. *Country-Level Life Cycle Assessment of Greenhouse Gas Emissions from Liquefied Natural Gas Trade for Electricity Generation*. Environ. Sci. Technol. 2018, 52, 1735-1746. [Hereinafter "Kasumu, 2018"]
3. Mallapragada, D. S.; Naik, I.; Ganesan, K.; Banerjee, R.; Laurenzi, I. J. *Life Cycle Greenhouse Gas Impacts of Coal and Imported Gas-Based Power Generation in the Indian Context.* Environ. Sci. Technol. 2019, 53, 539-549. [Hereinafter "Mallapragada, 2019"]

All three of these peer-reviewed studies found that natural gas exported from the United States in the form of LNG yields substantial net positive global GHG benefits:

Abrahams, 2015: "When considering a 100-year Global Warming Potential (GWP), mean life cycle emissions from exported U.S. LNG are 13% lower than those from Russian natural gas exports, and result in about 45% fewer emissions than coal electricity generation. When considering a 20-year GWP, exported U.S. LNG would reduce emissions from electricity production via Russian gas by 27% and cut emissions from electricity production from coal by 32%."

Kasumu, 2018: "Our results suggest that there is a net environmental benefit in terms of greenhouse gas emissions reduction when importing Canadian[4] natural gas for electricity generation in the five countries considered [China, India, Japan, South Korea, and Taiwan] except for the case of Japan prior to the Fukushima nuclear disaster...

As the world begins to transition to a lower carbon economy, new regulations and policies are being developed to move away from carbon-intensive sources such as coal, to less carbon-intensive sources, such as natural gas… When country level factors [are] applied to the base set of data, median life cycle emissions of LNG imports ranged from 568 gCO2e/kWh (Taiwan) to 872 gCO2 e/kWh (India). Estimates of median life cycle emissions arising from [Canadian] LNG exports were 562 gCO2 e/kWh and 666 gCO2 e/kWh, when power plant efficiencies of 55% HHV and 46.4% HHV were applied, respectively. The potential economic and environmental benefits [make] the justification for exporting natural gas from Canada to the Asia-Pacific region compelling, with China, India, Japan, South Korea, and Taiwan being the most likely destinations. [By comparison, the NETL 2019 Update estimates the GHG emissions of coal-to-power in China at 1,090 gCO2e/kWh.]

Mallapragada, 2019: On average, life cycle GHG emissions from [U.S.] LNG imported into India are ≈54% lower than those associated with Indian coal. However, the GHG intensity of the Indian coal-power

[4] Although this study considered natural gas produced in British Columbia, its primary focus was to consider GHG displacement at the receiving nation level and thus it is also generally applicable to natural gas produced south of the border in the United States.]

sector may be reduced by [a further] 13% by retiring plants with the lowest efficiencies and replacing them with higher-efficiency supercritical plants. Improvement of the CCGT fleet efficiency from its current level (41%) to that of a new plant with an F-class turbine (50%) could [also] reduce life cycle GHG emissions for LNG-sourced power by [a further] 19%.

Discussion: Conclusions Reached in the 2019 Update

As stated in the Introduction to the 2019 Update: "This analysis calculates the life cycle GHG emissions from imported natural gas and regional coal power in Europe and Asia. The primary research questions are as follows:

- How does exported LNG from the United States compare with regional coal (or other LNG sources) for electric power generation in European and Asian markets from a life cycle GHG perspective?
- How do those results compare with natural gas from Russia that is delivered via pipeline to the same European and Asian markets?"

[…]

This analysis has determined that the use of U.S. LNG exports for power production in European and Asian markets will not increase GHG emissions from a life cycle perspective, when compared to regional coal extraction and consumption for power production. [Emphasis Added]

The results show that for all 100-year time horizon scenarios the generation of power from natural gas has lower life cycle GHG emissions than power generation from regional coal…The interpretation of the 20-year natural gas scenarios is more complex due to the tradeoff between upstream GHG intensities and end use efficiencies. Specific conclusions: (1) On a 20-year GWP time horizon, the Russian natural gas and Algeria LNG scenarios have overlapping error bars with the regional coal scenarios; and (2) The U.S. LNG to Europe and Asia and Australia LNG scenario do not overlap the regional coal scenario on a 20-year time horizon.

Concluding Thoughts

LNG Allies finds that the conclusions reached in the 2019 Update—that the use of natural gas exported from the United States usually results in fewer electric power sector life cycle greenhouse gas emissions than either locally produced coal or pipeline gas—are in alignment with the research published by NETL in 2014 and the other LCA studies cited above. For these reasons we believe that DOE and other agencies are well advised to rely upon the 2019 Update in making their LNG "public interest" determinations.

Respectfully Submitted,

Fred H. Hutchison
President & CEO
LNG Allies, The US LNG Association