June 26, 2023

U.S. Department of Energy
Attn: Jared Ciferno
Office of Fossil Energy and Carbon Management
Forrestal Building
1000 Independence Ave. SW
Washington, DC 20585
VIA Email

RE: Notice of Request for Information on Opportunities to Reduce Greenhouse Gas Emissions and Other Air Pollutants Associated with U.S. Liquefied Natural Gas Exports (No. DE–FOA–0003052)

To the Department of Energy ("DOE") Office of Fossil Energy and Carbon Management ("FECM"):

Pursuant to the notice announcing a *Request for Information (RFI) on opportunities to reduce greenhouse gas emissions and other air pollutants associated with U.S. Liquefied Natural Gas (LNG) exports* published by the U.S. Department of Energy (DOE) in the Federal Register on April 26, 2023, 88 Fed. Reg. 25393, the Center for LNG (CLNG), the American Petroleum Institute (API), and the Natural Gas Supply Association (NGSA) (collectively, the Associations) submit the following comments.

I. Interest of CLNG, API and NGSA

CLNG advocates for public policies that advance the use of liquefied natural gas (LNG) in the United States, and its export internationally. A committee of NGSA, CLNG represents the full LNG value chain, including large-scale LNG export facilities in the United States, shippers, and multinational developers, providing it with unique insight into the ways in which the vast potential of this abundant and versatile fuel can be fully realized.

API represents all segments of America's natural gas and oil industry, which supports more than 11 million U.S. jobs and is backed by a growing grassroots movement of millions of Americans. API's approximately 600 members produce, process and distribute most of the nation's energy, and participate in API Energy Excellence®, which is accelerating environmental and safety progress by fostering new technologies and transparent reporting. As highlighted in the API *Climate Action*

Framework[1], API and its members are committed to delivering solutions that reduce the risks of climate change while meeting society's growing energy needs.

Founded in 1965, NGSA represents integrated and independent energy companies that produce, transport and market domestic natural gas and is the only national trade association that solely focuses on producer-marketer issues related to the downstream natural gas industry. NGSA's members trade, transact and invest in the U.S. natural gas market in a range of different manners. NGSA members transport and/or supply billions of cubic feet of natural gas per day on interstate pipelines.

Collectively, the Associations' value the opportunity to provide input on DOE's *RFI on opportunities to reduce greenhouse gas emissions and other air pollutants associated with U.S. Liquefied Natural Gas (LNG) exports***.** Our industry stands ready to work with DOE to reduce emissions, achieve our nation's climate commitments, and continue America's role of providing reliable, ever-cleaner energy to our allies around the world.

II. Comments

a. *The Associations' members are committed to reducing emissions and want to ensure that industry innovations, technologies, and initiatives can continue to develop without prescriptive limitations.*

The natural gas and LNG industry has always been an industry of great innovation. Their commitment to research and development has revolutionized not only the United States' energy landscape, but the way natural gas is used and distributed around the world. Two decades ago, domestic natural gas production was quickly declining, and the United States was slated to become one of the largest importers of LNG in the world—making U.S. consumers dependent on foreign countries for our energy needs. Thanks to the shale revolution and bipartisan support of American energy—including from this Administration—the United States is now a top exporter of LNG, while simultaneously maintaining a well-supplied domestic market. America has become a stabilizing force for global energy security, and, at home, the growth of the U.S. natural gas industry has created thousands of jobs, spurred economic development, and supported local communities.

As technology has evolved, groundbreaking innovations have helped reduce greenhouse gas (GHG) emissions in operations, services, and products. Increased industry investment in research and development has enabled the U.S. to lead the world in emissions reductions. The industry has embraced digitalization and new technologies like cloud computing, robotics, and 3-D imaging. Natural gas and LNG companies are developing and refining technologies to capture, store and reuse carbon. They are pioneering ways to recycle and reuse produced water and are developing smarter and safer ways to transport products. These innovations and others improve the quality of life and the environment in the U.S. and worldwide.

The Associations' members are committed to reducing GHG emissions and continuing to develop new and innovative ways to advance emission reductions. The Associations' members are eager to support DOE in their efforts to understand how the industry is working to reduce emissions along their

[1] American Petroleum Institute, *Climate*, https://www.api.org/climate.

value chain. Members also want to ensure that industry innovations, technologies, and initiatives are allowed to continue to develop, so that they can assist economies around the world in reaching their climate goals while helping maintain an affordable and reliable energy supply.

The Associations suggest that it would be unproductive for DOE to use this RFI to mandate specific technologies or emission reduction tools because it will likely hinder the development, deployment, and investment in new abatement innovations. Technology in the energy sector is constantly changing and improving, often rapidly. Without the flexibility for companies to pursue their individual emissions reduction strategies and investments in technological innovations, a company or industry sector could easily be left disadvantaged, with limited ability to contribute to U.S. climate goals and economic development.

Further, each LNG and natural gas project is unique, with varying geologic, economic and demographic considerations. The type of emission abatement tools appropriate for one project won't necessarily work for another because of these factors and differences in individual projects' size, scope, and objectives. Additionally, LNG producers have a range of business models and corporate structures with varying degrees of control over the gas that is processed in their facilities—making a potential one-size-fits-all type requirement problematic. Requiring specific technologies or tools to reduce emissions would signal that DOE values those technologies over others, potentially slowing investment in other valuable emissions reduction technologies.

b. The RFI and its received responses should not indicate a license to begin imposing requirements on LNG projects that go beyond DOE's legal mandate under the National Environmental Policy Act of 1969 (NEPA).

Exporting natural gas requires authorization from DOE and from the Federal Energy Regulatory Commission (FERC). FERC is responsible for authorizing the siting, construction, and operation of onshore LNG facilities under Section 3 of the Natural Gas Act (NGA). FERC is also responsible for preparing an environmental assessment or an environmental impact statement for proposed LNG facilities, as required by NEPA. FERC is the Lead Federal Agency in preparing the overall NEPA documentation for LNG facilities. As the Lead Federal Agency, FERC has invested significant resources into ensuring a robust NEPA review.

Upon request of the Lead Federal Agency, any other federal agency which has jurisdiction by law shall be a cooperating agency. DOE is a cooperating agency to FERC regarding the NEPA review for LNG. DOE, under Section 3 of the NGA, authorizes the export of natural gas unless it finds that the export is not consistent with the public interest.

DOE's jurisdiction rests solely with the export of LNG. DOE lacks the authority to approve the construction or operation of the LNG facility itself, that authority rests solely with FERC. DOE does not need to review potential environmental impacts from the construction and operation of the LNG facility (as enunciated in the United States Supreme Court in *Public Citizen* and the D.C. Circuit in *Sierra Club*[2]),

[2] *See* Department of Transportation v. Public Citizen, 541 U.S. 752 (2004); Sierra Club v. Federal Energy Regulatory Commission, 827 F.3d 36 (D.C. Cir. 2016). When making a determination based on the NEPA analysis, only the information that is useful to the environmental decisionmaker need be presented. NEPA analysis has limits and, as enunciated in *Public Citizen* and *Sierra Club,* the "rule of reason" limits agency obligation under NEPA. The agency need only consider the environmental information

which will continue to be reviewed by FERC. Instead, DOE's review should be limited to the potential environmental impacts that are within DOE's authority, namely the impacts that occur at or after the point of export.

Further, DOE should keep in mind that upstream and downstream emissions are already regulated by multiple layers of federal and state regulations. Congress imbued the Environmental Protection Agency (EPA) with the authority to regulate air emissions, including GHGs, through the Clean Air Act (CAA). The CAA established a strong regulatory program, supervised by the EPA, to comprehensively address interstate air pollution.[3] As the Supreme Court explained, "Congress designated an expert agency, here, EPA, as best suited to serve as primary regulator of greenhouse gas emissions."[4] The EPA has taken significant steps to regulate GHG emissions from pipeline facilities and other sources and has a proposed rule under the CAA to further limit emissions of methane from facilities in the oil and natural gas sector, which it has been regulating since 2011.[5]

States also play an important role in regulating air emissions under the CAA. Congress intended for states to have a significant role in establishing measures to mitigate emissions from stationary sources. The CAA acknowledges state authority to issue permits to regulate stationary sources related to upstream and downstream activities. Many states have also taken significant steps to regulate GHG emissions by enacting laws aimed at reducing GHG emissions.

As described above, natural gas facilities' emissions are subject to extensive regulations from the EPA and the states. And while one can debate whether NEPA's intended scope of review includes indirect GHG emissions, the fact is that activities and facilities upstream and downstream of the LNG project are in many cases already covered by the regulations of other federal and state agencies. Further, the U.S. natural gas industry is committed to reducing emissions and advancing climate solutions. Industry supports well-designed regulation of methane from new and existing sources. Along with preparing to comply with these regulations, the natural gas industry is making significant voluntary efforts to reduce methane emissions. With continued technological innovation and concerted industry efforts, methane emissions decreased nearly 60 percent across all seven major U.S. producing regions from 2011 to 2021.[6]

In reviewing this RFI, we ask DOE to consider existing climate regulations. Creating duplicative procedures could cause confusion, create potential regulatory contradictions, and add new hurdles to an already lengthy permitting process for LNG facilities, ultimately preventing the timely deployment of emission reduction technologies and chill LNG infrastructure development. Further, any action taken by DOE as a result of this RFI should be done through the proper process with opportunities for comment and redress. DOE should always provide regulatory certainty to the greatest extent possible. Prudent, well-thought-out regulation is necessary for companies to consider investing in expensive new

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that is of use and relevant to the decisionmaker. An agency does not need to evaluate an environmental effect where it "has no ability to prevent a certain effect due to its limited statutory authority over the relevant actions."

[3] Massachusetts v. EPA, 549 U.S. 497, 532 (2007)

[4] Am. Elec. Power Co. v. Connecticut, 564 U.S. 410, 428 (2011).

[5] Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review, 86 Fed. Reg. 63,110 (Nov. 15, 2021).
Supplemental Update, 87 Fed. Reg. 74,702 (Dec. 06, 2022).

[6] U.S. EPA Greenhouse Gas Reporting Program (GHGRP), https://www.epa.gov/ghgreporting.

technologies. Companies are less likely to make such investments without government agencies' commitment to the proper regulatory process.

c. LNG exports have global environmental benefits and influence decisions other countries make regarding their energy mix.

The natural gas industry is a partner in the transition to a lower-carbon future, and exporting U.S. LNG is one of the ways the industry is working to reduce emissions on a global scale while meeting the energy demands for a growing population. As countries choose to increase their use of natural gas for power generation, they can reduce their GHG emissions through fuel switching from coal to natural gas while simultaneously increasing the deployment of renewable energy. Accordingly, U.S. LNG is central to helping to ensure countries around the world can responsibly meet their climate and energy security goals.

The energy crisis in Europe has demonstrated the importance of the U.S. LNG industry and a robust global LNG market. Although U.S. LNG is not the sole solution to the EU's energy supply crunch, the U.S. has been the EU's largest supplier of LNG throughout their energy crisis. After Russia's February 2022 invasion of Ukraine, U.S. LNG exports to Europe increased by 141% from 2021—staving off the worst-case scenarios for our European allies.[7] Further, having a robust supply of LNG on the global market is critical to helping developing nations reduce their GHG emissions. Natural gas power generation is an ideal partner to intermittent renewable energy resources, given its ability to quickly provide real-time reactions to changing power supply and demand responses. However, without a sufficient supply of LNG on the global market, developing countries will struggle to create a sustainable decarbonization strategy.

Global energy and climate conversations often proceed as though coal has already been eliminated from the global energy system and that gas is engaged in a zero-sum competition with renewable energy development. However, this is false, last year the world burned more coal than at any point in recorded history, and approximately 40 gigawatts of new coal plants were approved—almost all of which are in China. This trend may continue through this year; the International Energy Agency (IEA) expects investment in coal supply to rise by 10 percent in 2023.[8]

As a responsible and reliable supplier of natural gas to global markets, the U.S. can play a primary role in reducing GHG emissions in these countries by decreasing reliance on coal for power generation. America has led the world in emissions reduction since 2005 largely due to the shift in power generation fuel from coal to natural gas[9] – providing a template for countries looking to replicate similar emission reductions. DOE should recognize the benefits that U.S. LNG can provide after the point of export. Any action taken by DOE in response to this RFI must consider the value and emissions reductions that U.S. LNG provides to countries around the world.

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[7] "Europe Was the Main Destination for U.S. LNG Exports in 2022." U.S. Energy Information Administration, 22 Mar. 2023, www.eia.gov/todayinenergy/detail.php?id=55920#:~:text=In%202022%2C%20Europe%20increased%20LNG,according%20to%20data%20from%20Cedigaz.

[8] "World Energy Investment 2023." International Energy Agency, May 2023, https://www.iea.org/reports/world-energy-investment-2023.

[9] "Electric power sector CO2 emissions drop as generation mix shifts from coal to natural." U.S. Energy Information Administration, 9 June 2021. https://www.eia.gov/todayinenergy/detail.php?id=48296.

III. DOE RFI Topic 1: Environmental Profile of Upstream Supplies

a. *1.1 What technologies or strategies are being used to mitigate the greenhouse gas emissions and other environmental impacts of the natural gas delivered to a liquefaction facility?*

Reducing the emissions intensity of LNG begins with upstream production. Broadly, upstream producers are utilizing many different strategies to reduce emissions from their operations.

- Electrification: upstream producers are electrifying their operations at natural gas production sites by using lower-emission power, which may include wind, solar, hydro, and natural gas.
- Flaring reductions: upstream producers are employing programs to eliminate and reduce routine flaring.
- Methane detection and monitoring: upstream producers are reducing methane emissions through detection and mitigation technology, such as the use of forward looking infrared (FLIR) handheld gas detection scanners, drone/aerial technologies, and in-plant gas monitoring systems in leak detection and repair programs. Detection of fugitive emissions enables operators to quickly identify and repair leaks.
- Pneumatic devices: pneumatic devices are used to control the conditions of natural gas and are powered by natural gas. During normal operations, some natural gas is vented into the atmosphere. Transitioning from high-bleed pneumatic devices to low- or no-bleed devices or electrical pumps or controllers can reduce vented emissions associated with these devices.
- Commercializing and scaling carbon capture and storage (CCS): investing in CCS and assessing the potential to implement CCS at natural gas processing facilities will greatly reduce emissions.
- Offsetting emissions: employing high-quality carbon credits to offset emissions that cannot be reduced through operational changes.

b. *1.5 What role do or could differentiated natural gas certification programs (also referred to as certified natural gas or responsibly sourced natural gas) play in helping ensure the suppliers of natural gas sourced for export have taken measures to mitigate greenhouse gas emissions and other environmental impacts?*

Certified natural gas can complement efforts already underway to directly reduce methane emissions both voluntary and regulated. To be effective, certified gas must be a voluntary market-based solution that is inclusive, liquid, and transparent.

c. *1.6 What differentiated natural gas certification programs are LNG companies currently using? Are there any market gaps currently not filled by existing programs?*

LNG and natural gas companies use both in-house and independent measurement protocol programs:

- Companies such as Project Canary, MiQ, and Equitable Origin have measurement protocol programs that are used by LNG operators.
- The International Group of Liquefied Natural gas Importers ("GIIGNL") and its 84 member companies of LNG importers have developed measurement and independent verification (MRV) and GHG Neutral LNG Framework which has a reporting format for both full cycle and individual stage reporting.
- Some LNG operators are working independently with producers to understand the full emissions profiles of the natural gas they are exporting. They are providing that information to their customers voluntarily.

d. 1.7 What role do or could differentiated natural gas certification programs play in helping to create a competitive advantage for U.S. natural gas in foreign markets as compared to other sources of natural gas? Do or could such programs facilitate long-term contracting by purchasers of U.S. natural gas?

LNG buyers and natural gas consumers around the world are showing increased interest in transparency around the GHG emission profile associated with the energy they purchase. Certified natural gas programs are only in the early stages of development and have had little if any impact on the global LNG market to date.

The Associations support the development of voluntary and transparent differentiated natural gas data to inform markets; however, prematurely imposing shortsighted requirements on U.S. producers could put U.S. LNG exporters at a serious disadvantage against global competitors.

IV. DOE RFI Topic 2: Strategies to Measure and Reduce Emissions at Liquefaction Facilities

a. 2.1 What technologies or strategies are companies deploying to reduce greenhouse emissions at liquefaction facilities?

LNG companies are employing a variety of strategies to reduce emissions at liquefaction facilities, depending on their individual facilities and strategic plans. Described below are a variety of technologies that LNG companies are employing to reduce emissions at their facilities.

- High efficiency gas turbines*:* the use of high efficiency gas turbines requires less natural gas, reducing emissions from the liquefaction process.
- Electrification: electrification of components of the liquefaction process can reduce facility emissions. Operators are also committing to sourcing renewable energy to power their electrified processes.
- Waste heat recovery: for waste heat recovery, liquefaction facilities capture heat that is emitted from liquefaction processes before it enters the atmosphere. This heat can then be used in other processes or to generate electricity.
- Seal gas recovery: compressors used at liquefaction facilities can result in small amounts of natural gas into the atmosphere. Seal gas recovery captures this gas before it can be emitted.
- Leak detection and repair (LDAR): LDAR programs allow operators to quickly identify and repair leaks, minimizing the emissions associated with the leaked gas entering the atmosphere. As

discussed below in Section 2.4, companies are employing innovative technologies to support improved LDAR programs and minimize emissions.

- Pressure safety valve monitoring: these valves are intended to manage pressure in production processes, releasing gas when needed. However, leaky valves may result in unintentional emissions. Increased monitoring of these valves improves leak detection, minimizing subsequent gas leaks.
- Compressed air valve control: LNG facilities may use compressed air to control valves (instead of using natural gas), which reduces vented emissions.
- Pneumatic devices: pneumatic devices are used to control the conditions of gas and are powered by natural gas. During normal operations, some of this gas is vented into the atmosphere. Transitioning from high-bleed pneumatic devices to low- or no-bleed devices or electrical pumps or controllers can reduce vented emissions associated with these devices.
- Pipe flange management: using specific types of pipe flanges and ensuring regular inspection and maintenance can reduce vented emissions.
- Flaring reductions: companies are implementing flaring reduction programs to reduce emissions associated with the venting and flaring of gas. This may include supporting the elimination of routine flaring.
- Carbon capture and storage: as discussed in Section 2.9, companies are developing CCS projects for liquefaction facilities or are assessing the potential of CCS project development.

Supply Chain Emissions Reductions

Along with pursuing emissions reductions within their own operations, LNG companies are making efforts to decarbonize their supply chains. Companies are engaging with their upstream suppliers on sustainability issues through supplier codes of conduct and sustainability programs. Companies also work with their value chain to support emissions data collection and monitoring efforts.

Climate Reporting

LNG companies report on their emissions and decarbonization strategies to promote transparency and a better understanding of how the industry addresses climate change. This includes reporting on company GHG emissions, emissions reductions initiatives, climate goals, and other relevant information. Such reporting efforts demonstrate industry's commitment to better understanding and quantifying their GHG emissions, enabling them to make informed decisions regarding their climate strategies.

Many LNG companies are utilizing voluntary frameworks to guide their climate disclosures. Frameworks such as the Taskforce on Climate-related Financial Disclosures (TCFD), Global Reporting Index (GRI), and the Sustainability Accounting Standards Board (SASB) guide companies in disclosing relevant climate information to support stakeholder needs. Transparently reporting climate-related issues allows stakeholders to understand industry emissions and reduction efforts and enables companies to develop individual emissions reduction strategies tailored to their operations and impacts.

Cross-Industry Collaboration

Along with their individual efforts, many LNG companies are collaborating with other organizations and academic institutions to support emissions reductions across the industry. For example, GTI Veritas

is a methane emissions measurement and verification protocol developed with industry support. GTI Energy also administers the Collaboratory to Advance Methane Science (CAMS) - an industry-led research collaboration dedicated to improving the understanding of methane science by evaluating new tools and technologies to detect, measure, and quantify methane emissions. The Energy Emissions Modeling and Data Lab (EEMDL) is also supported by industry in its efforts to develop a global data and analytics hub to support improved GHG emissions accounting across energy supply chains.

Additionally, LNG companies are working across industry and with academia on lifecycle analyses and studies to assess industry emissions, such as a first-of-its-kind study on the emissions from LNG carrier ships.[10]

b. *2.4 Are companies deploying advanced technologies, such as drones or aerial surveys, to monitor greenhouse gas emissions at liquefaction facilities? If so, what technologies are they using or planning to use?*

Companies are exploring the use of advanced monitoring and detection technologies at liquefaction facilities. Forward looking infrared handheld gas detection scanners, or optical gas imaging (OGI) cameras, are being used to detect natural gas leaks, which can then be repaired to prevent further emissions. Companies are also assessing the potential to employ advanced monitoring technologies such as drones, aerial surveys, satellites, and continuous monitors at their facilities. These technologies can improve facility monitoring, enabling operators to identify leaks which can then quickly be repaired.

c. *2.9 Do companies have specific plans to deploy carbon dioxide capture at liquefaction facilities in the future on low and high purity CO_2 gas streams? In addition to financial considerations, are there technical or other limitations to deploying carbon dioxide capture at liquefaction facilities?*

LNG companies are exploring the complementary use of CCS for their liquefaction facilities. High purity CO_2 streams are the best candidate for carbon capture. Liquefaction's place in the value chain often comes after the bulk of CO_2 has been performed in upstream producing and processing operations. Some LNG companies are implementing CCS projects to capture and store emissions from their liquefaction operations, while others are assessing potential opportunities to utilize CCS for their facilities. In addition to financial limitations, the regulatory and technical landscape are currently driving the timeline and ability to implement specific plans to deploy CCS. Permitting timelines create significant obstacles to efficiently deploying CCS and CO_2 pipelines. Operators planning to inject and geologically store CO_2 must obtain a Class VI permit through EPA's Underground Injection Control (UIC) program. However, the timeline and requirements for obtaining a Class VI permit are significant. To date EPA has approved six total Class VI permits, two of which are active.[11] There are currently over 80 Class VI permit applications waiting for EPA approval.[12]

Deploying CCS will also require significant infrastructure buildout, including CO_2 pipelines needed to transport captured CO_2 to geological storage. The construction of CO_2 pipelines may require

[10] "Total Methane and CO2 Emissions from Liquefied Natural Gas Carrier Ships: The First Primary Measurements," Environmental Science &Technology, June 2022, https://pubs.acs.org/doi/10.1021/acs.est.2c01383.
[11] "Letter to Congress Regarding EPA Class VI Permitting Report," U.S. Environmental Protection Agency, https://www.epa.gov/system/files/documents/2022-11/EPA%20Class%20VI%20Permitting%20Report%.20to%20Congress.pdf
[12] "Class VI Wells Permitted by EPA," U.S. Environmental Protection Agency, *https://www.epa.gov/uic/class-vi-wells-permitted-epa.*

additional permits with lengthy, unclear timelines for approval. The uncertainty associated with the permitting process for both injection wells and CCS infrastructure may limit companies' willingness to invest, hindering CCS implementation.

Alongside regulatory obstacles, the ability for facilities to implement CCS is limited by their local geology. Existing facilities may not have local geology suitable for CO_2 storage, and therefore may be unable to currently implement CCS. To retrofit these facilities, CO_2 transport infrastructure would need to be developed to allow them to transport the captured CO_2 to a suitable geologic site.

For more information on the deployment of CCS at liquefaction facilities, DOE may consider coordinating with the federal agencies that are actively regulating CCS. As discussed above, EPA regulates underground injection for storage. Information on the LNG production process and mitigation planned at liquefaction facilities is discussed as part of the FERC environmental assessment process. DOE may wish to engage with these agencies to further understand the current status and potential for future CCS deployment at liquefaction facilities.

VI. DOE RFI TOPIC 3: Strategies to Measure and Reduce Emissions during Loading, Transport, and Delivery

a. 3.1 What technologies or strategies are being deployed to reduce greenhouse gas emissions during the loading, transport, and delivery of LNG?

LNG companies are employing a variety of practices and technologies to reduce emissions from the loading, transport, and delivery of LNG.

- Boil-off and ship vapor recovery: use of boil-off gas (LNG that is vaporized during normal operation as well as during ship loading) and returning it for liquefaction instead of flaring it.
- Efficiency initiatives: various initiatives to promote efficiency of LNG transport, including switching to higher-efficiency engines for LNG carriers, hull coatings to reduce friction, and efficient propeller selection. LNG companies may seek to charter the most efficient LNG carriers to reduce their emissions from shipping.
- Natural gas fuel propulsion: using natural gas propulsion in LNG carriers, replacing more emissions-intensive diesel engines.
- Tracking shipping emissions: cross-industry collaboration on a study to directly measure methane emissions of an operating LNG vessel, enabling LNG carriers to identify opportunities for environmental performance improvement.[13]
- Study of alternative fuels: research into alternative fuels for shipping can lay the foundation for future emissions reductions. Alternative fuels such as hydrogen, biofuels, and ammonia are currently being researched to assess feasibility.

In addition to these industry efforts, the International Maritime Organization is working extensively to reduce emissions from international shipping broadly. IMO has established emissions reduction goals for the shipping industry, aiming to reduce the industry's total emissions by 2050. Their strategy for achieving this goal includes energy efficiency measures, development of low- and zero-carbon fuels, and

[13] "Total Methane and CO2 Emissions from Liquefied Natural Gas Carrier Ships: The First Primary Measurements." Environmental Science &Technology, June 2022, https://pubs.acs.org/doi/10.1021/acs.est.2c01383.

additional emissions reduction innovations.[14] The IMO's work will continue to support emissions reductions within LNG shipping.

V. Conclusion

The Associations appreciate the opportunity to comment on the DOE's RFI. We hope to work with DOE as the industry continues to develop new technologies to reduce emissions and reach our nation's net zero goals.

Sincerely,

/x/ Katharine Ehly
Katharine Ehly
Senior Policy Advisor
Natural Gas Supply Association
Center for Liquified Natural Gas
900 17th Street NW, Suite 500
Washington, D.C. 20006
Katherine.ehly@ngsa.org

/x/ Rob Jennings
Rob Jennings
Vice President, Natural Gas Markets
American Petroleum Institute
200 Massachusetts Ave, NW
Washington, DC 20001
JenningsR@api.org

[14] "Achieving the IMO decarbonization goals", DVN, July 2020. *https://www.dnv.com/expert-story/maritime-impact/How-newbuilds-can-comply-with-IMOs-2030-CO2-reduction-targets.html#.*