U.S. House of Representatives Committee on Energy and Commerce Subcommittee on Energy, Climate, and Grid Security February 6, 2024, Hearing: *Politics Over People: How Biden's LNG Export Ban Threatens* America's Energy and Economic Security

Questions for the Record from the Honorable Scott Peters (D-CA) to Gillian Giannetti, Senior Attorney, Natural Resources Defense Council, Sustainable FERC Project

Question 1: Let's assume that Republicans are able to repeal all fees, regulations and incentives that encourage industry to reduce methane emissions. What would happen to the planet and local communities if we allow methane emissions to continue and increase unchecked?

Answer: If Congress and the President were to repeal these initiatives, and irresponsibly and unnecessarily high methane emissions levels were allowed to continue, it would be virtually impossible to keep the target of limiting warming to 1.5°C within reach—even 2°C would be extraordinarily difficult to achieve. To avoid these consequences, Congress and the Biden Administration have enacted a comprehensive and complementary set of incentives, rules, and fees that work together to cut dangerous methane emissions and have been carefully tailored to address the conditions we have in the United States (U.S.) These initiatives—and the reasons behind them—are discussed below.

Oil and gas production and distribution is the largest industrial source of methane pollution in the U.S.¹ Methane is a super global warming pollutant; it packs 80 times the punch of carbon dioxide in the first two decades after its release.² Methane is responsible for approximately 30% of the rise in global temperatures since the Industrial Revolution,³ and it accounts for approximately 1/3 of current warming from human activities.⁴

According to the International Energy Agency (IEA), the production and use of fossil fuels resulted in nearly 120 million metric tonnes (Mt) of methane emissions in 2023⁵—that is the equivalent of the CO₂ emissions of 864 coal-fired power plants in one year.⁶ The U.S. led the world in methane emissions in 2023, emitting 13.3Mt, with Russia second at 11.2Mt.⁷ A July 2023 study by the Environmental Defense Fund similarly found that U.S. oil and gas companies

¹ "GHGRP and the Oil and Gas Industry," U.S. EPA, https://tinyurl.com/bdfveaxp (last visited Mar. 15, 2024) (hereinafter GHGRP).

² Josie Garthwaite, *Methane and Climate Change*, STANFORD UNIV. (Nov. 2, 2021), https://sustainability.stanford.edu/news/methane-and-climate-change-0#.

³ "Global Methane Tracker 2023," IEA, https://www.iea.org/reports/global-methane-tracker-2023 (last visited Mar. 15, 2024) (hereinafter GMT 23).

⁴ GHGRP, supra note 1.

⁵ "Global Methane Tracker 2024: Key findings," IEA (last visited Mar. 15, 2024), https://tinyurl.com/y767te9s (hereinafter GMT 24).

⁶ "Greenhouse Gas Equivalencies Calculator," U.S. EPA, https://tinyurl.com/yr7tzbvy.

⁷ "Methane emissions from oil and gas production and methane intensity for selected producers, 2023," IEA (Mar. 13, 2024), https://tinyurl.com/89neev45 (last visited Mar. 15, 2024).

emit upwards of 16Mt of methane annually;⁸ this has the same short-term climate impact of 350 coal-fired power plants.⁹

These alarming emissions rates are compounded by leakage, which recent studies suggest is far worse than previously thought. For example, in 2022, Stanford University researchers used airborne sensors to detect methane leaks from oil and gas production facilities in the Permian Basin in New Mexico. They found that over 9% of all methane produced in the region is leaked—a number far higher than previous estimates of 1.4%. ¹⁰ Globally, large methane emissions detected by satellites rose by more than 50% in 2023, with over 5Mt of methane emissions detected from leaks worldwide. ¹¹

Leakage rates also severely undermine the claim that LNG in general, and U.S. LNG, in particular, is clean. For example, a March 2024 Wood Mackenzie noted, "not all LNG projects are created equal. GHG footprints vary depending on the CO2 content of the reservoir gas, levels of methane leakages from production, infrastructure and processing, and how liquefaction and regasification are powered." In other words, leakage plays a key role in identifying and determining an LNG project's overall impact on the climate.

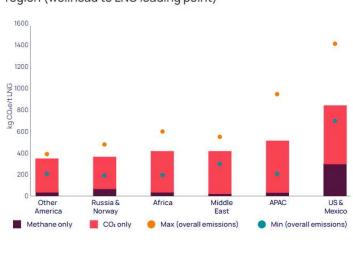


Figure 1: GHG emissions intensity (kg/CO2 equivalent) by region (wellhead to LNG loading point)

Source: Wood Mackenzie LNG Carbon Emissions Tool

⁸ Press Release, "Report: Methane Measurement Industry is Ready to Scale Up to Meet the Demand for Accurate, Real-World Data," ENVTL. DEF. FUND (July 12, 2023), https://tinyurl.com/4a4rze6w.

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⁹ Press Release, "U.S. Tightens Limits on Oil and Gas Methane to Address One of Nation's Largest Pollution Sources," ENVTL. DEF. FUND (Dec. 2, 2023), https://tinyurl.com/yeyszkfb.

¹⁰ Andrew Myers, *Methane leaks are far worse than estimates, at least in New Mexico, but there's hope*, STANFORD UNIV. (Mar. 24, 2022), https://tinyurl.com/f3sj7uj8 (hereinafter Myers Leakage).

¹¹ GMT 24, *supra* note 5.

¹² Massimo Di Odoardo *et al.*, *Call of duties: How emission taxes on imports could transform the global LNG market*, Wood Mackenzie (Mar. 2024), https://tinyurl.com/3s6dnfyx (hereinafter Wood Mackenzie).

¹³ *Id*.

With respect to U.S. LNG, the Wood Mackenzie study found that "methane only accounts for 5% to 15% of overall carbon intensity in LNG projects outside the US. But for LNG projects in the US, methane can account for as much as 25% to 40% due to higher levels of methane losses largely because of the extensive use of pneumatic devices and compressors associated with shale gas production." In fact, according to Wood Mackenzie, "the US has some of the world's highest-emitting projects, with upstream reservoir type and pipeline distance to LNG plants adding to their high methane intensity." 15

Fortunately, the U.S. has already taken several critical steps to addressing this problem. First, the U.S. is a co-lead of the Global Methane Pledge (GMP), which seeks to reduce global methane emissions by at least 30% from 2020 levels by the end of the decade. Leading and joining the GMP demonstrates a commitment to take comprehensive domestic actions to achieve methane emissions reductions, as well as a dedication to developing sophisticated methodologies for quantifying methane emissions, including leaks. For example, the Biden Administration has identified the following goals to tackle the climate crisis: (1) reduce U.S. greenhouse gas emission to 50-52% below 2005 levels in 2030; (2) reach 100% carbon pollution-free electricity by 2035; (3) achieve a net-zero emissions economy by 2050; and (4) deliver 40% of the benefits from federal climate and clean energy investments to disadvantaged communities. These goals form part of the U.S.' Nationally Determined Contribution (NDC)—or individual nation climate pledge—which is a component of the historic 2020 Paris Agreement.

Second, many subnational governments, including California, are looking to act on methane in their jurisdictions. For example, at COP28, California launched a new Subnational Methane Action Coalition with signatories from 15 subnational governments around the world; this program will facilitate greater cooperation and the sharing of best practices. ¹⁹

Third, in 2021, the Biden Administration launched the first U.S. International Climate Finance Plan²⁰ and committed to work with Congress to scale up international public climate finance to over \$11 billion annually from Fiscal Year 2024. To that end, U.S. international public climate finance increased 286% from 2021 to 2022, reaching \$5.8 billion in 2022; preliminary

¹⁴ *Id*.

¹⁵ *Id*.

¹⁶ Gloria Dickie, *Methane emissions from energy sector rose in 2023 despite climate pledges*, REUTERS (Mar. 13, 2024), https://tinyurl.com/4edjjkcp.

¹⁷ "President Biden's Historic Climate Agenda," https://www.whitehouse.gov/climate/# (last visited Mar. 15, 2024).

¹⁸ Fact Sheet, "President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies," The White House (Apr. 22, 2021), https://tinyurl.com/ywyfhpyc.

¹⁹ Press Release, "California launches methane-cutting effort with subnational governments at COP28," CAL. AIR RESOURCES BD. (Dec 3, 2023), https://tinyurl.com/366545wx.

²⁰ Executive Summary, "U.S. International Climate Finance Plan," The White House (Apr. 22, 2021), https://tinyurl.com/rff26btf.

estimates suggest that U.S climate finance exceeded \$9.5 billion in 2023, putting the U.S. in striking distance of meeting its 2024 target.²¹

Fourth, new Environmental Protection Agency (EPA) regulations published on March 8, 2024, will achieve dramatic reductions in methane emissions by applying straightforward, available, and cost-effective emission control technologies and practices. ²² EPA estimates that its final rule will cut methane pollution from covered sources by 80% relative to a "business as usual" scenario. ²³ It also projects that the rule will prevent an estimated 58 million tons of methane emissions from 2024-2038—equal to 1.5 billion metric tonnes of carbon dioxide, which is nearly as much as all the carbon dioxide emitted by the power sector in 2021. ²⁴

Furthermore, as part of the landmark Inflation Reduction Act (IRA), the Methane Emissions Reduction Program (MERP) will provide more than \$1 billion in financial and technical assistance to address methane emissions and leaks. ²⁵ For example, on February 9, 2024, EPA and the Department of Energy announced its intent to make funds available to help measure and reduce methane emissions from the oil and gas industry. ²⁶ Relatedly, EPA's proposed methane fee²⁷ will incentivize companies to prioritize methane reductions. For example, the Wood Mackenzie study notes that the IRA's methane charge should encourage "considerable further emission reductions ... even without considering an import tax in Europe." ²⁸

These initiatives are an important first step in ensuring that the U.S. demonstrates a leadership role regarding climate action and finance, something that, historically, it has not done. As noted by the Climate Action Tracker (CAT), while recent efforts are a "major step forward, it is imperative that the US adopts equally bold policy packages at the sectoral level and shifts away from the increasing reliance on fossil fuels to achieve the pace and scale of emission reductions needed to meet its NDC target. Without additional, drastic emission reductions measures, the US will still be far from meeting its domestic climate target, let alone get its emissions onto a 1.5°C trajectory. Overall, the CAT rates the US climate targets, action and

²¹ Fact Sheet, "Progress Report on President Biden's Climate Finance Pledge," U.S. Dep't of State (Dec. 2, 2023), https://www.state.gov/progress-report-on-president-bidens-climate-finance-pledge/#.

²² 89 Fed. Reg. 47, 16820-17227 (Mar. 8, 2024).

²³ Accelerating Progress: The U.S. Methane Reduction Action Plan, THE WHITE HOUSE (Dec. 2023), https://www.whitehouse.gov/wp-content/uploads/2023/12/Methane-Action-Plan-2023-Topper.pdf.

²⁴ Press Release, "Biden-Harris Administration Finalizes Standards to Slash Methane Pollution, Combat Climate Change, Protect Health, and Bolster American Innovation," U.S. EPA, https://tinyurl.com/hc9b5f6k.

²⁵ "Methane Emissions Reduction Program," U.S. EPA, https://tinyurl.com/y9wwshdn (last visited Mar. 15, 2024).

²⁶ Press Release, "EPA and DOE announce intent to fund projects to reduce methane emissions from the oil and natural gas sectors as part of President Biden's Investing in America agenda," U.S. EPA (Feb. 9, 2024), https://tinyurl.com/3kttr76h.

²⁷ Press Release, "Biden-Harris Administration Announces Proposed Rule to Reduce Wasteful Methane Emissions from the Oil and Gas Sector to Drive Innovation and Protect Communities," U.S. EPA (Jan. 12, 2024), https://tinyurl.com/ypk3h78e.

²⁸ Wood Mackenzie, *supra* note 12.

climate finance as 'Insufficient.'"²⁹ This is why a 2°C scenario (let alone 1.5°C) would be so difficult to achieve were the U.S. to change course.

But it's not just the pure climate emissions benefits that would be lost, but also the downstream effects. For example, the economic benefits of these reductions—estimated by the U.S. Treasury at \$5.6 trillion—would be lost.³⁰ Insurance rates would likely increase, our national security would be compromised from greater exposure to pollution and climate risks, and public health would suffer. Despite the 77% reduction in air pollution emissions achieved since passage of the Clean Air Act in 1970, air pollution still causes an estimated 197,000 premature deaths in the U.S. each year. The IRA "will avert thousands of hospitalizations, reduce health care costs, and increase the economic productivity of a healthier, longer-lived population."³¹

Globally, abandoning these programs would signal to our allies that the U.S. is unwilling to walk the walk on climate leadership. Not only would this weaken our relationships with critical partners in Europe and Asia, but it would encourage bad actors, such as Russia, to use this backward step to delay raising their climate targets under the next cycle of the Paris Agreement roadmap commitments due in early 2025. This would only exacerbate the severity of global warming impacts here and abroad, and add to the suffering and harm for millions of people due to rising temperatures and extreme weather driven by climate pollution.

In sum, "rapid and sustained reductions in methane emissions are key to limiting near-term global warming and improving air quality" and abandoning these efforts would have catastrophic consequences.

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²⁹ "USA," CLIMATE ACTION TRACKER (Nov. 1, 2023), https://climateactiontracker.org/countries/usa/ (last accessed Mar. 15, 2024).

³⁰ Arik Levinson *et al.*, *The Inflation Reduction Act's Benefits and Costs*, U.S. Dep't of Treasury (Mar. 1, 2024), https://home.treasury.gov/news/featured-stories/the-inflation-reduction-acts-benefits-and-costs#.

³¹ Sanjay Rajagopalan & Philip J. Landrigan, *The Inflation Reduction Act – implications for climate change, air pollution, and health*, LANCET REG. HEALTH AM. 2023 Jun 10;23:100522. doi: 10.1016/j.lana.2023.100522. PMID: 37333687; PMCID: PMC10276136.

³² "Building Support for More Ambitious National Climate Action Plans," UNFCCC (Mar. 14, 2024) https://unfccc.int/news/building-support-for-more-ambitious-national-climate-action-plans (last visited Mar. 25, 2024).

³³ GMT 23, *supra* note 3.

Question 2a: The prevailing narrative is that LNG exports to our allies, as well as to developing nations, displace dirtier coal and oil powered generation. Our LNG exports also displace Russian gas, which is dirtier than American LNG. However, in the long term, we'll have to think about how we reduce fossil fuel demand, along with winding down fossil fuel production and supply.

a. Do American LNG exports increase foreign reliance on fossil fuels?

Answer: At the outset, liquefied natural gas (LNG) is a fossil fuel. There is no such thing as a clean fossil fuel, including natural gas sourced from the U.S. And as the Wood Mackenzie study illustrates,³⁴ the claim that U.S. LNG is the "greenest and cleanest" is questionable at best.

As to whether U.S. LNG exports increase foreign reliance on fossil fuels, the reality is that, despite the aggressive marketing of U.S. LNG, developed economies in both Asia and Europe are already implementing measures that are expected to dramatically reduce their demand for gas. These developments significantly increase the risk that future LNG export projects, including those in the U.S., will become unnecessary.

A recent Institute for Energy Economics and Financial Analysis (IEEFA) analysis outlines this stranded asset risk. IEEFA reviewed the Biden Administration's LNG pause's potential effects on global energy supplies. It first noted that the U.S. currently has under construction projects with a combined capacity of 74Mt—enough to nearly double domestic export capacity by 2030.³⁵ These projects are entirely unaffected by the pause.

Globally (mostly in the U.S. and Qatar), the world is set to add 64 million tonnes per annum (MTPA) of export capacity in 2026, with another 37 MTPA targeting completion in 2027. By the end of 2027, the U.S. Energy Information Administration estimates that LNG export capacity will grow by 1.1 billion cubic feet per day (Bcf/d) in Mexico, 2.1 Bcf/d in Canada, and 9.7 Bcf/d in the U.S. Again, these projects are entirely unaffected by the pause.

IEEFA further noted that Japan and South Korea, which traditionally have been the U.S.' largest LNG customers in Asia, are entering a plateau and are set to dramatically reduce their LNG demand. Specifically, Japan's LNG demand fell 8% in 2023; this trend is expected to continue, leaving utilities with persistent LNG oversupply through 2030.³⁸ Similarly, South Korea's climate and energy targets suggest that its LNG demand could fall 20% by 2036.³⁹ This trend of weakening demand in key historical markets for U.S. LNG is critical to analyzing the

³⁴ See Wood Mackenzie, supra note 12.

³⁵ "Fact Sheet: U.S. LNG Pause Does Not Impact Asia's Energy Security," IEEFA, https://ieefa.org/sites/default/files/2024-03/Asia%20Energy%20Security%20LNG%20Pause%20Factsheet.pdf (last visited Mar. 15, 2024) (hereinafter IEEFA Fact Sheet).

³⁶ *Id*

³⁷ "LNG export capacity from North America is likely to more than double through 2027," U.S. EIA (Nov. 13, 2023), https://www.eia.gov/todayinenergy/detail.php?id=60944.

³⁸ "Japan's declining gas demand will leave utilities with persistent LNG oversupply through 2030," IEEFA (Mar. 11, 2024), https://tinyurl.com/4sabkdr9.

³⁹ IEEFA Fact Sheet, *supra* note 35.

potential effects of the LNG pause, as the projects affected would not come online until the 2030s or beyond.

The long-term gas demand story is similar in the European Union (EU). The EU's strategic response to the war in Ukraine, REPowerEU, aims to eliminate dependence on Russian gas by 2027 and halve overall gas demand by 2030. 40 As outlined by E3G, "[g]as use in the EU is already on the decline, with a 13% reduction in gas demand recorded in 2022 and a similar trend in 2023. Existing US LNG infrastructure can adequately address European energy security concerns, surpassing the outlined need for 50 [billion cubic meters] of new LNG imports in REPowerEU." Recent legislative packages, including the Fit for 55 package, are projected to further reduce EU gas demand by 29% by 2030. 42 Additionally, according to the IEA's latest estimates, by the end of 2023, nearly 60 governments had completed or were in the process of completing national methane action plans, with many more engaged on methane action planning; this is expected to further reduce gas use and gas dependency abroad. 43

Thus, despite the push to rapidly expand domestic LNG export capacity, the countries that have traditionally purchased U.S. LNG are moving away from expanding fossil fuel use.

With respect to developing economies, which are more price sensitive, continued reliance on gas, be it from the U.S. or elsewhere, risks energy instability and economic slowdown.⁴⁴ Furthermore, investing in LNG import infrastructure diverts limited funds away from clean and more forward-looking ventures, such as expanding renewable energy and developing a more efficient and resilient transmission grid.

Accordingly, continued unfettered U.S. LNG expansion either risks becoming a stranded asset or slowing down critical energy transitions in the Global South—neither of these options are desirable or exemplify the U.S.' ability for climate leadership.

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⁴⁰ Raphael Hanotreaux & Maria Pastukhova, *Declining EU gas demand diminishes need for US liquified natural gas*, E3G (Mar. 11, 2024), https://tinyurl.com/4hcjpaf3.

⁴¹ *Id*.

⁴² *Id*.

⁴³ "What did COP28 mean for methane?" IEA, https://www.iea.org/reports/global-methane-tracker-2024/what-did-cop28-mean-for-methane#abstract (last visited Mar. 15, 2024).

⁴⁴ Shruti Shukla & Ade Samuel, *Growth of U.S. LNG Exports Puts Global Climate at Risk*, NRDC (June 16, 2022), https://www.nrdc.org/bio/shruti-shukla/growth-us-lng-exports-puts-global-climate-risk.

Question 2b: The prevailing narrative is that LNG exports to our allies, as well as to developing nations, displace dirtier coal and oil powered generation. Our LNG exports also displace Russian gas, which is dirtier than American LNG. However, in the long term, we'll have to think about how we reduce fossil fuel demand, along with winding down fossil fuel production and supply.

b. How will this complicate the eventual global energy transition in the long term?

Answer: Again, it is important to remember that LNG is a fossil fuel. There is no such thing as a clean fossil fuel, including natural gas sourced from the U.S. And as the Wood Mackenzie study illustrates,⁴⁵ the claim that U.S. LNG is the "greenest and cleanest" is questionable at best.

With respect to whether further U.S. LNG export will complicate the energy transition, put simply, continuous expansion of natural gas production, export, and use is patently incompatible with meeting domestic and global climate goals. 46

To be on a 1.5°C pathway, global consumption of natural gas needs to decline by around 20% from today's levels by 2030 and be on a path to a cut of over 75% by 2050.⁴⁷ 2030 is not the distant future: it is six years away. And the Biden Administration's pause on far future LNG exports to non-Free Trade Agreement nations does not affect projects that are on track to be completed before 2030.

Additionally, the fossil fuel industry's claims about LNG supplanting coal are oversold and, in some cases, flatly inaccurate. Currently, the world's top consumers of coal are China (54%), India (16%), the U.S. (5%), and the EU (4%). In the EU, coal consumption has been rapidly decreasing for years—it is expected to drop by 44% from 2022 levels by 2026—and it's expected to continue to decrease with or without LNG, due to improvements in energy efficiency, expansion of clean energy, and the need to meet the EU's legally-binding climate targets. Additionally, most of Europe's natural gas is used for home heating, a sector in which coal has long played a limited role. In the energy of the coal has long played a limited role.

In Asia, the story is more complicated, but it still is not as simple as the fossil fuel industry advertises. The largest expected Asian buyers of U.S. LNG later in the decade are China, India, Japan, South Korea, and Thailand and, of those, only China and India have any plans to build new coal power plants.⁵¹ Even in China, coal's share of electricity generation has

⁴⁵ See Wood Mackenzie, supra note 12.

⁴⁶ Christina Swanson & Amanda Levin, *Sailing to Nowhere: Liquefied Natural Gas Is Not An Effective Climate Strategy*, NRDC (Dec. 2020), https://tinyurl.com/49uyk3bw.

⁴⁷ Jake Schmidt, Ade Samuel & Shruti Shukla, *Liquefied Natural Gas Has Limited Impact In Displacing Coal Emissions*, NRDC (Jan. 24, 2024), https://tinyurl.com/3ybtjf6s.

⁴⁸ *Id*.

⁴⁹ *Id*.

⁵⁰ *Id*.

⁵¹ *Id*.

declined, with natural gas-powered electricity remaining flat at just 3% since 2015.⁵² Instead, the share of wind and solar generation quadrupled in China's power generation (from 4% to 16% percent) over the same period.⁵³ Thus, while natural gas may play some role in reducing coal use in the power sector, it is simply untrue that massive U.S. LNG development will inherently lead to widespread coal use reductions.

Furthermore, there is mounting evidence that LNG's value chain is far more emissions-intensive that previously estimated.⁵⁴ This is because "every molecule of methane leaked alters the climate advantage [of natural gas] because methane warms the planet significantly more than CO₂ over its decade-long lifetime."⁵⁵ A recent analysis found that even a methane leakage rate as low as 0.2% can cause natural gas to be as harmful to the climate as coal.⁵⁶ Given that leakage rates in the Permian Basin can exceed 9%,⁵⁷ it is possible that natural gas sourced from the Permian and exported overseas is actually worse than coal on a life-cycle basis.

Continued expansion of U.S. LNG export will also increase energy costs here at home. For example, a new National Bureau of Economic Research (NBER) working paper suggests that, by 2030, U.S. prices will be 54% higher than they would have been in a less exportintensive scenario. According to the paper, this is the equivalent of a \$30-per-ton carbon tax on natural gas emissions. Other papers have similarly argued for the connection between expanded LNG export and increased domestic gas prices. 60

In short, continuing to build out more LNG infrastructure, without properly accounting for its climate, environmental and economic impacts, could severely frustrate our ability to move the global energy system to one that is cleaner, safer, affordable, climate compatible, and ensures environmental justice for our communities.

Submitted: March 25, 2024 Gillian R. Giannetti Senior Attorney, NRDC Sustainable FERC Project

⁵² IEEFA Fact Sheet, *supra* note 35.

⁵³ *Id*.

⁵⁴ Deborah Gordon *et al.*, Evaluating net life-cycle greenhouse gas emissions intensities from gas and coal at varying methane leakage rates, 18 ENVTL. RESEARCH LETTERS 8 (July 17, 2023), https://tinyurl.com/yx6avpcw.

⁵⁵ Id

⁵⁶ *Id. See also* IEEFA Fact Sheet, *supra* note 35.

⁵⁷ Myers Leakage, *supra* note 10.

⁵⁸ James H. Stock & Matthew Zaragoza-Watkins, *The Market and Climate Implications of U.S. LNG* Exports, NBER (Mar. 2024), https://www.nber.org/papers/w32228. See also Melvin Backman, *America exports so much natural gas that Americans are paying more for it*, QUARTZ (Mar. 12, 2024), https://qz.com/natural-gas-exports-expensive-nber-paper-1851325301.

⁵⁹ Id

⁶⁰ E.g., Sean Smillie et al., Greenhouse Gas Estimates of LNG Exports Must Include Global Market Effects, 56 ENVTL. SCI. TECHNOL. 2 (Jan. 5, 2022), https://pubs.acs.org/doi/10.1021/acs.est.1c04753.