METHANE TRACKING IN TOKYO BAY

EMISSIONS FROM LNG INFRASTRUCTURE IN JAPAN

OILFIELD WITNESS

FoE Japan

OIL CHANGE INTERNATIONAL

Oilfield Witness is an environmental organization that uses optical gas imaging technology to document pollution from the oil and gas industry–directly in the oilfield. We leverage this data and analysis to educate the public and policy makers to transition away from fossil fuels and towards clean renewable energy. www.oilfieldwitness.org

Friends of the Earth Japan (FoE Japan) is an environmental organization. We work to protect the environment and promote social and environmental justice. As a member organization of Friends of the Earth International, which has 2 million supporters in more than 70 countries, FoE Japan has been active in Japan since 1980. www.foejapan.org/en

Oil Change International is a research, communications, and advocacy organization focused on exposing the true costs of fossil fuels and facilitating the coming transition towards clean energy. Oil Change International. www.oilchange.org

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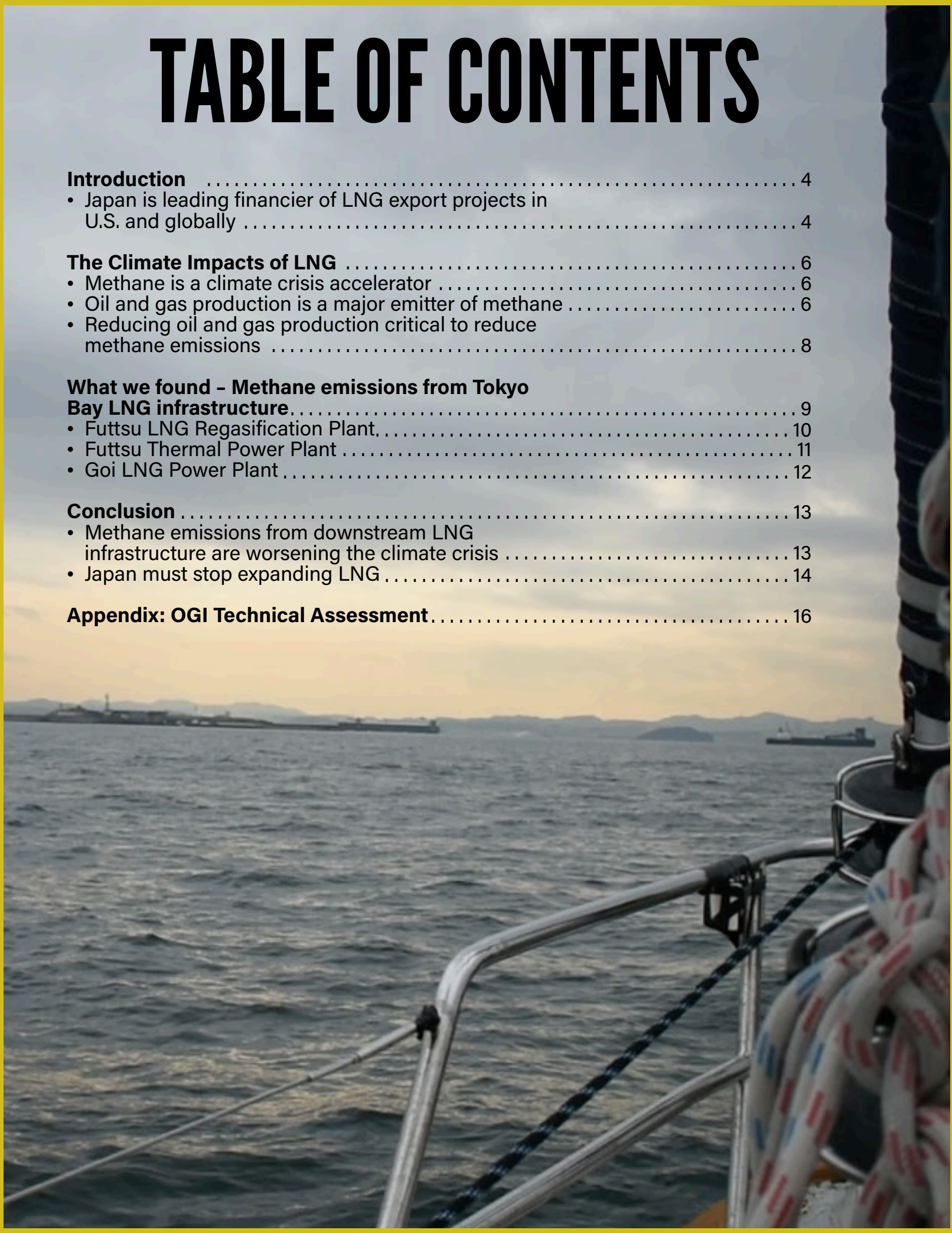


1. INTRODUCTION

Oilfield Witness certified optical gas imaging thermographers have over a decade of experience documenting methane emissions from gas and liquefied natural gas (LNG) infrastructure in the U.S. This work has helped expose the serious impacts of gas and LNG infrastructure on communities, ecosystems, and the climate.

In February 2025, Oilfield Witness experts traveled to Japan for an unprecedented field investigation to track methane emissions from LNG import terminals and gas plants along Tokyo Bay. We captured video footage of significant methane emissions from the Futtsu LNG import terminal, Futtsu gas power plant, and the Goi LNG power plant. This video evidence exposes the damaging impact of LNG and gas infrastructure on communities and our climate.

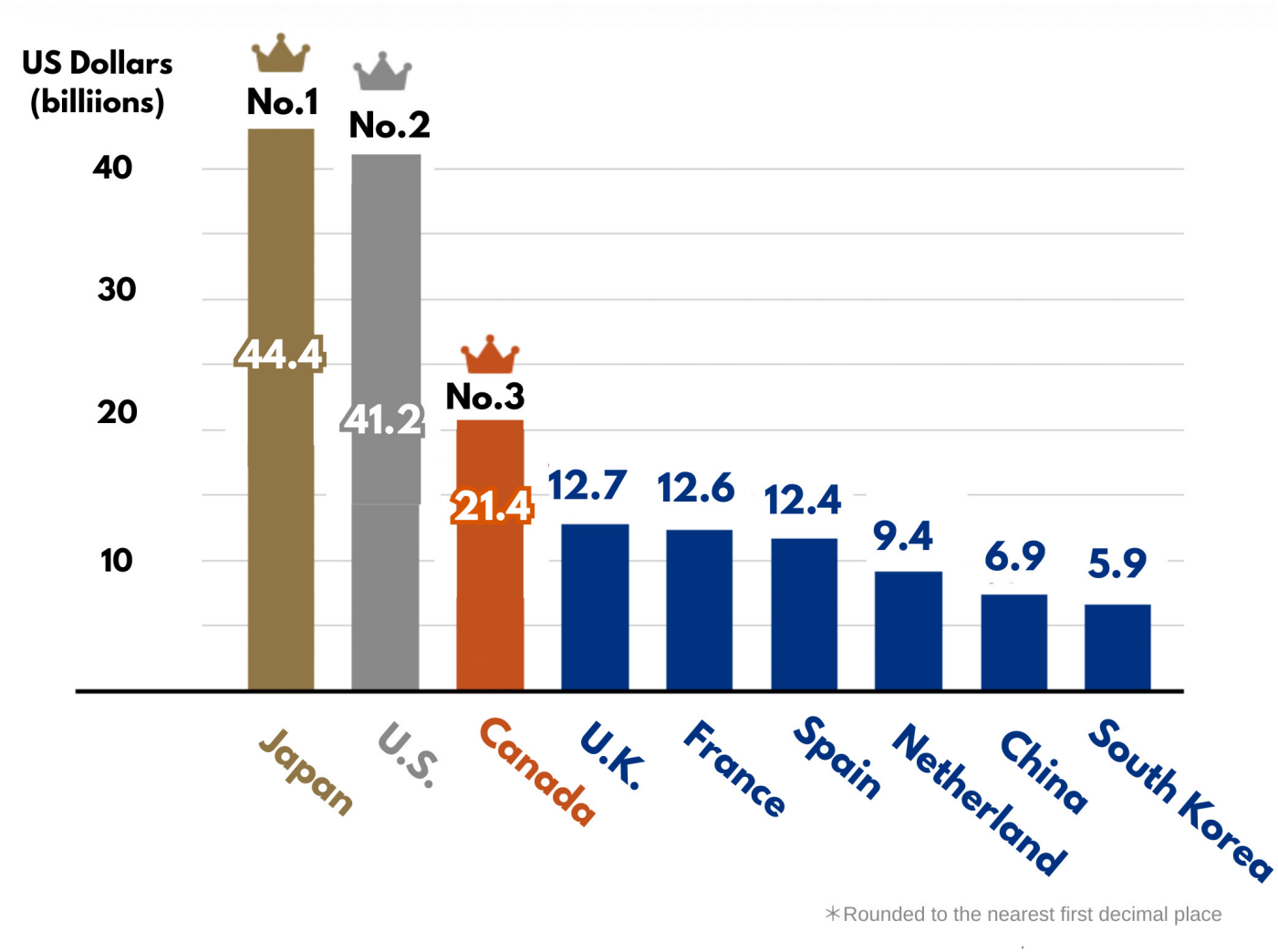
Japan is leading financier of LNG export projects in U.S. and globally

Japan is driving the expansion of gas and LNG through its international public and private finance. Japan is the world's largest provider of international public finance for LNG export capacity globally, accounting for roughly 50% of global public finance for LNG export terminals built from 2012 to 2022 and terminals currently under construction or set to be completed by 2026.[1] Japan is also one of the world's top public financiers for gas, spending an average of $4.3 billion per year.[2]

For LNG export capacity, the amount of Japanese private and public financing surpasses the total amount financed by American financial institutions - total financing from Japanese banks amounts to around US$44.4 billion (see Figure 1).[3] Following Japanese Prime Minister Shigeru Ishiba's promise to buy "record amounts" of U.S. LNG, Japanese institutions provided financing for the controversial Calcasieu Pass 2 export terminal and Freeport LNG developer.[4] [5] JERA signed deals with four U.S. LNG producers to buy up to 5.5 million tons per year of LNG.[6]

Japanese private banks MUFG, Mizuho, and SMBC are the first, second, and third biggest financiers of LNG export projects in the U.S. These banks have committed more than $13 billion, $11 billion, and $10 billion, respectively, to U.S. LNG projects.[7] Japanese public financial institutions, such as Japan Bank for International Cooperation (JBIC) and the Nippon Export and Investment Insurance (NEXI) financed Cameron LNG and Freeport LNG export terminals. NEXI is considering providing insurance for the expansion of Cameron LNG.[8]

Figure 1: Financing Amount of Each Country to US LNG Export Projects



＊Rounded to the nearest first decimal place

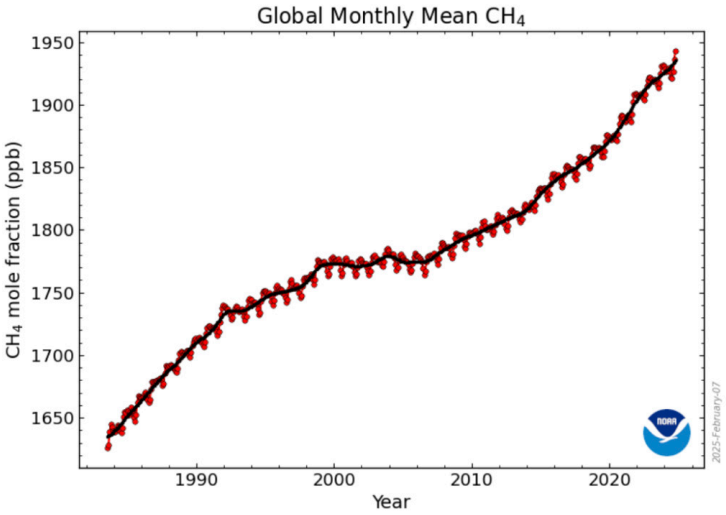
Source: Created by FoE Japan, based on Sierra Club's "US LNG Export Tracker "(Last accessed June 27, 2025)

2. CLIMATE IMPACTS OF LNG

Methane is a climate crisis accelerator

Methane is a greenhouse gas over 80 times more powerful than carbon dioxide for the first 20 years of its presence in the atmosphere. Pollution starts with drilling a hole in the ground, which in the case of shale formations in the U.S., Canada and elsewhere, is then fracked to release oil and gas. Along the whole supply chain, from the hole in the ground, processing, liquefaction, transportation, regasification, and finally combustion, gas pollutes communities and the environment, and the associated methane emissions are a major contributor to climate change.

Figure 2: Global methane emissions continue to set new records every year



Source: National Oceanic and Atmospheric Administration (NOAA)[10]

After remaining relatively stable in the first decade of the 21st century, global methane levels have risen quickly since 2010 and continue to set new records every year (see Figure 2).[9]

Oil and gas production is a major emitter of methane

The production of fossil fuels is one of the major contributors to man-made methane emissions (agriculture and landfills are the other two). According to the International Energy Agency's 2025 Global Methane Tracker report, the U.S. oil and gas industry emits more methane than any other country's oil and gas sector and 75 percent more than the second ranking country, Russia (see Figure 3).[11]

In the past several years, satellite and airplane surveys found much higher levels of emissions from U.S. oil and gas production than the industry reports. In March 2024, the journal *Nature* published a Stanford analysis that found that methane emissions from U.S. oil and gas production were three times higher than industry and government estimates.[13]

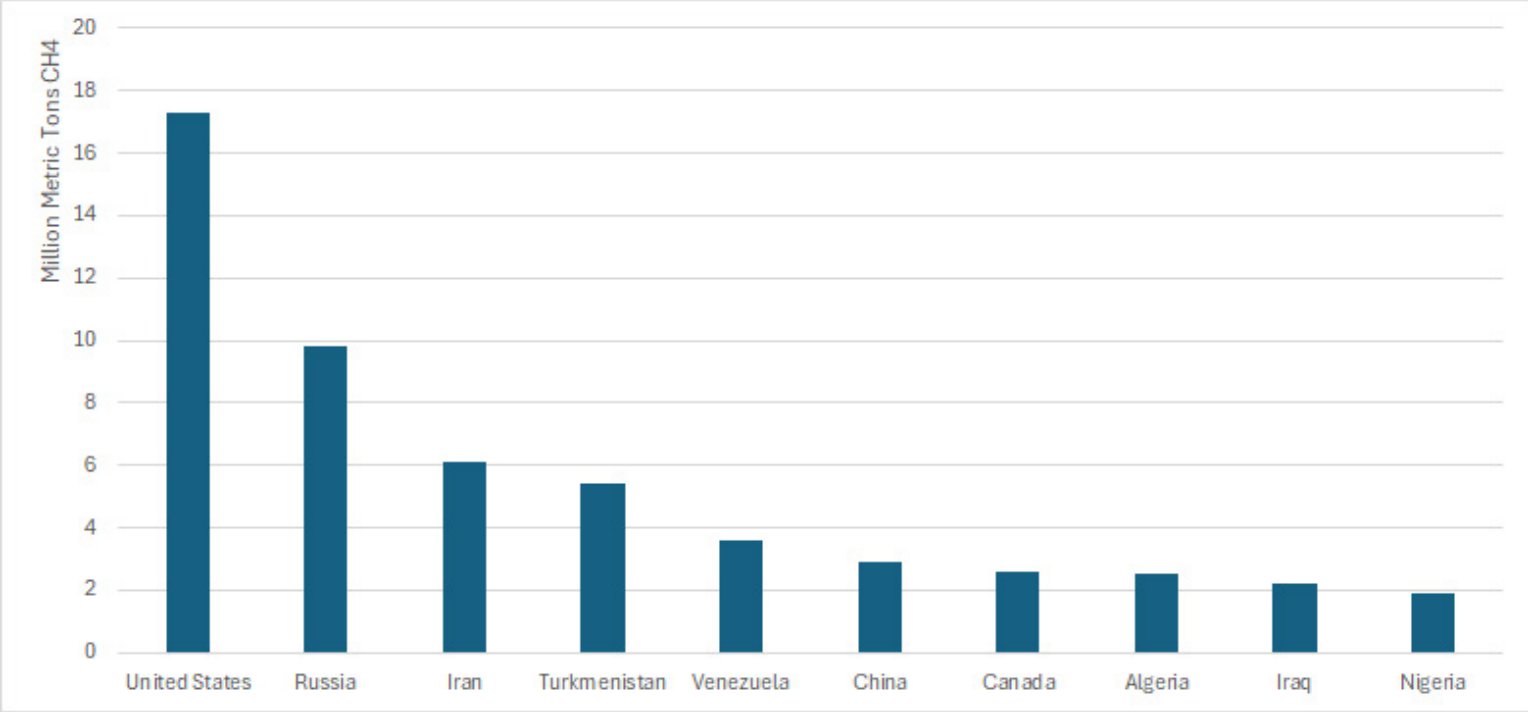
2. CLIMATE IMPACTS OF LNG

The Permian Basin, in West Texas and South-East New Mexico, is the largest source of oil and gas in the U.S.[14] Numerous pipelines connect it to the Gulf Coast LNG terminals. It is also reported to have some of the highest methane emissions rates in the country. One study found rates as high as 9.4% of gas production in the New Mexico portion of the basin,[15] with other studies finding leakage rates across the basin around 3.7%.[16] With the recent rollback of new methane regulations, this is likely to worsen.[17]

Due to the high amount of methane emissions associated with producing LNG in the U.S., importing LNG to be burned for power generation can have higher total emissions than burning coal for power generation.[18]

Further, increased U.S. LNG exports are more likely to displace new renewable generation rather than coal. The U.S. Department of Energy (DOE) confirmed this development with its 2024 analysis that concluded that in every scenario, "increases in LNG exports would lead to increases in global net emissions."[19] According to then U.S. Energy Secretary Jennifer M. Granholm, "additional U.S. LNG exports displace more renewables than coal globally."[20]

Figure 3: Top 10 Countries by Estimated Oil & Gas Sector Methane Emissions - 2024



Source: International Energy Agency[12]

Reducing oil and gas production critical to reduce methane emissions

According to climate experts, reducing methane emissions could have the most significant impact on slowing climate change in the next few decades. Martina Otto of the UN Environment Programme, which hosts the Global Methane Pledge, stated, "Reducing methane emissions this decade is our emergency brake in the climate emergency."[21]

Despite numerous pledges and the development of technology to detect methane emissions, oil and gas sector methane emissions continue to rise along with production. The IEA acknowledges that the oil and gas industry's methane emissions "have still not reached a definitive peak."[22] The IEA's own modeling clearly shows that there is no room for any new LNG export projects if the world is to avoid the very worst impacts of the climate crisis.[23] The only way to rapidly reduce methane emissions from oil and gas is to reduce oil and gas production.

Despite this, Japan is financing more gas and LNG projects in the U.S. and is driving gas expansion globally. This threatens to cause significant harm to communities and ecosystems and jeopardize a liveable planet for future generations.

3. WHAT WE FOUND

Methane emissions from Tokyo Bay LNG infrastructure

On February 1st and 3rd, 2025, Oilfield Witness experts traveled to the Tokyo Bay area to track potential methane emissions from the Futtsu LNG import terminal, Futtsu gas power plant, and the Goi LNG power plant. Certified thermographer Sharon Wilson brought her Optical Gas Imaging (OGI) camera to visualize emissions that are invisible to the naked eye.

Oilfield Witness staff use a Teledyne FLIR G620 optical gas imaging (OGI) instrument and are certified through the Infrared Training Center. An optical gas imaging instrument uses a cooled filter that is calibrated to a narrow range of the magnetic spectrum where hydrocarbons like methane and volatile organic compounds absorb infrared. As the hydrocarbons absorb infrared, they become opaque, and the onboard camera records the images. These emissions are invisible to the naked eye.

Sharon Wilson was first certified in 2014 and has recertified twice since then. OGI images are evidence of pollution, and Sharon's videos have been used in court cases and hearings. OGI is used by regulatory agencies and by the industry. All of the Oilfield Witness videos are peer-reviewed. Oilfield Witness thermographers receive ongoing continued education with a Level III OGI instructor to ensure our videos meet the highest industry standards.

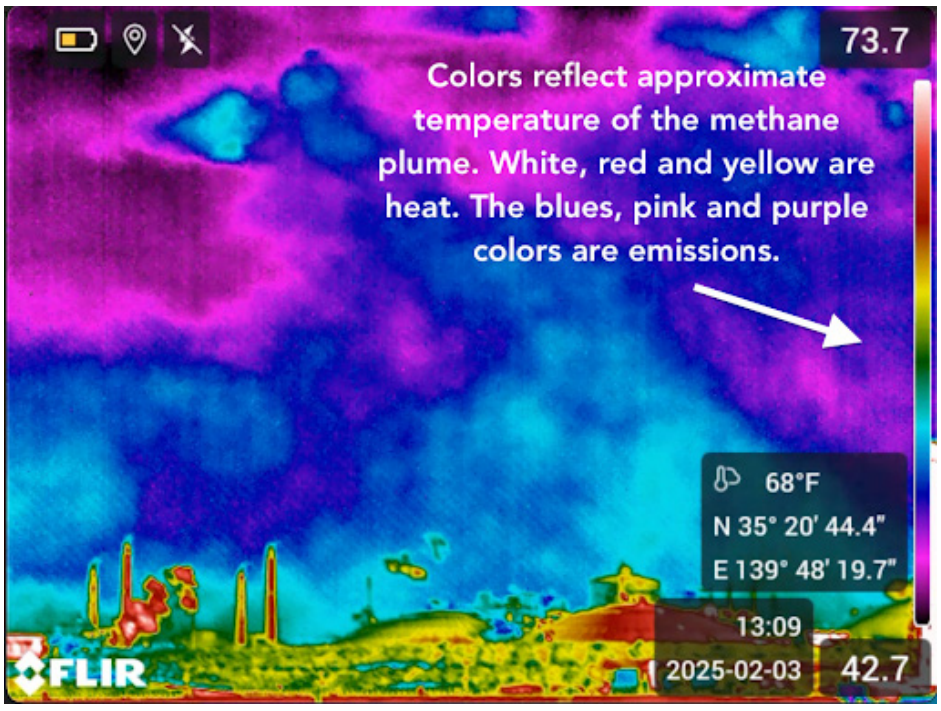
A. Futtsu LNG regasification plant

JERA's Futtsu LNG regasification terminal located on Tokyo Bay in Futtsu City, Chiba Prefecture received its first LNG shipment in 1985 and its 4000th shipment in April 2024.[24] [25] The Futtsu Thermal Power Plant is adjacent. A regasification terminal receives shipments of LNG and then converts the LNG back into a gaseous form. The regasified methane, commonly called natural gas, is then sent through pipelines to power plants, industrial and residential consumers.

The OGI video of the Futtsu terminal was recorded using the camera's Auto mode in both the grey scale and rainbow color palettes. Photos were used to demonstrate that methane emissions are not visible with the bare eye. We captured footage showing methane emissions rising up over the plant. This was distinguished from areas of steam that are visible to the bare eye.

Scan QR code to view narrated video, or use this URL: bit.ly/futtsuLNG

Figure 4: Description of rainbow palette colors in relation to heat.



The rainbow palette is used at the 1:17 minute mark on the video. The rainbow color palette is used to visualize the approximate span of temperatures of the plume. The small graph on the right side of the video window shows a color spectrum that corresponds with an approximate temperature. White, red and yellow are very hot. The colors at the top indicate heat and as the plume becomes ambient temperature it is reflected by the colors toward the bottom. In the rainbow palette, the edges of the methane plume emerging from the Futtsu terminal are easily seen in bright pink.

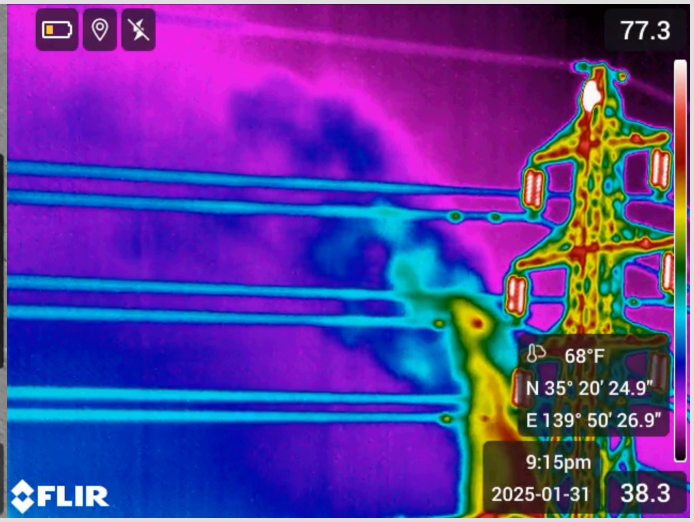
Warming up LNG to turn it back into methane gas increases the kinetic energy of molecules and causes them to bounce around inside the steel tanks. This increases pressure that can rupture equipment if not released. This explains why the methane plume appears denser over the tanks. The tall stack at the end of the video is intended to combust methane converting it into carbon dioxide and water vapor. However, our video footage shows that the gas was not fully combusted, and as a result, a plume of uncombusted methane was released.

B. Futtsu Thermal Power Plant

This is one of the largest thermal power plants in Japan, capable of generating a total of 5,160 MW.

The Futtsu thermal power plant is surrounded by a tall fence. We captured footage of methane emissions from three stacks of the Futtsu power plant. Using the rainbow palette, our video showed emissions coming from two large vertical stacks and a smaller stack. Using the different camera modes including rainbow, high sensitivity and auto, we could detect the methane emissions and differentiate them from heat. We used high sensitivity mode to capture the motion of the methane emissions.

Scan QR code to view narrated video, or use this URL: bit.ly/futtsuplant



C. Goi LNG Power Plant

Goi Thermal Power Station in Chiba Prefecture, Japan started operation in 2024. It has 3 units with a generating capacity of 780 MW for each, totaling 2,340 MW.

We recorded OGI video footage of the Goi LNG power plant owned by JERA. We captured footage of methane blasting from three stacks at the power plant into the atmosphere. Clouds of uncombusted methane, particulate matter and VOCs were documented using the OGI rainbow palette, high sensitivity and auto modes. The video footage in auto mode showed the plume of emissions travelling far from the plant and into the neighboring communities nearby. This pollution is impacting the air quality neighboring communities breathe.

We also detected methane emissions from three emission sources at another part of the Goi power plant. We found a small tank that appeared to be releasing pressure by venting methane into the atmosphere. The other two emissions sources showed methane being released that was not fully combusted.

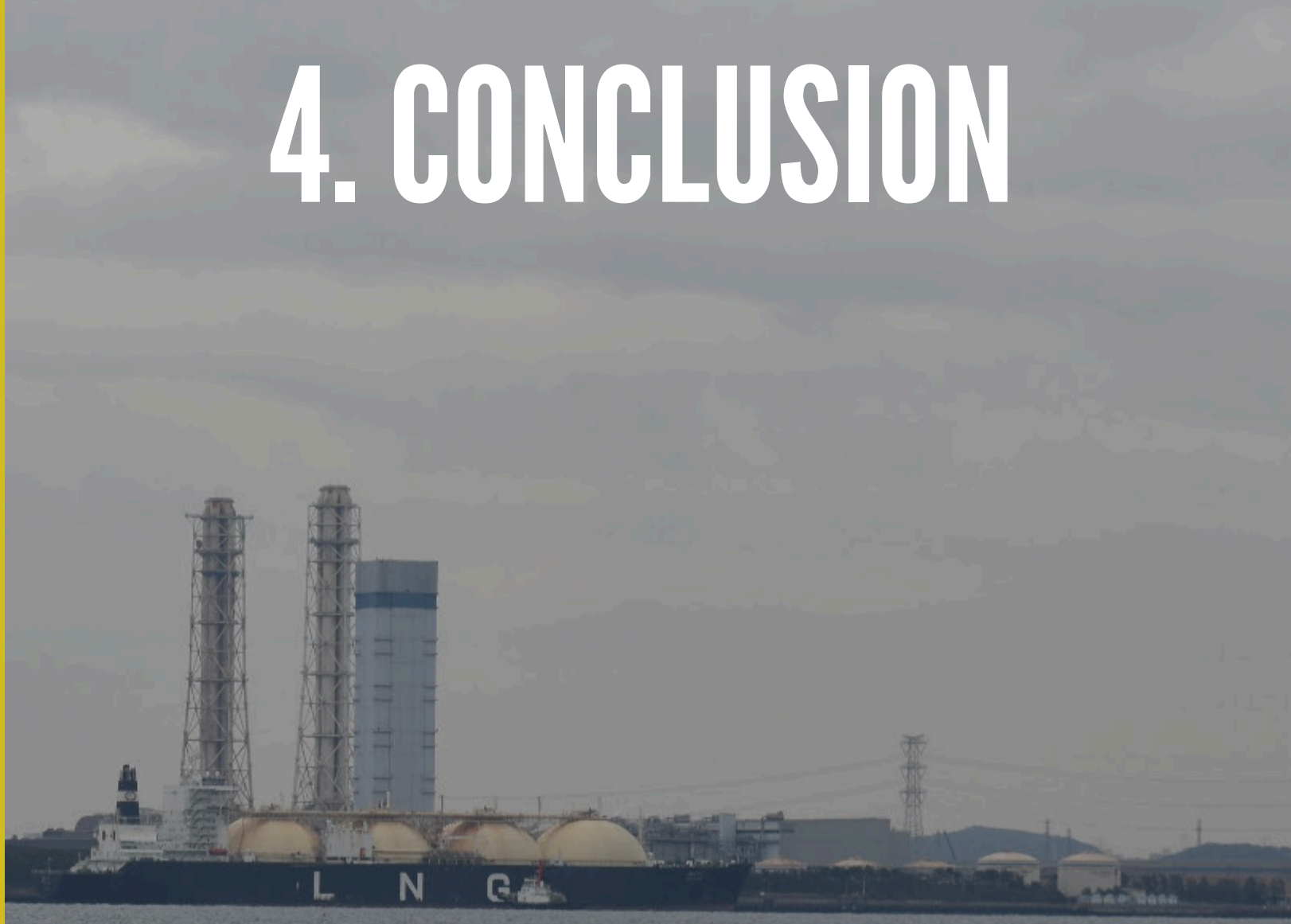
Scan QR code to view narrated video, or use this URL: www.bit.ly/goiplant

Methane emissions across the LNG supply chain

Documentation of LNG regasification and import terminals in Japan, allowed Oilfield Witness to compile the following video: a collection which visualizes emissions from each stage of the LNG lifecyle. From drilling and fracking in the Permian to pipeline transportation in Texas to LNG export in the Louisiana Gulf Coast to LNG import in Tokyo Bay, Japan--LNG entails climate-destroying methane pollution.

Scan QR code to view narrated video, or use this URL: bit.ly/LNGcycle

4. CONCLUSION



Methane emissions from downstream LNG infrastructure are worsening the climate crisis

Oilfield Witness staff found that methane emissions coming from the Tokyo Bay LNG infrastructure are consistent with the observed evidence of methane emissions collected by thermographer Sharon Wilson from LNG and gas infrastructure located across the U.S. and in the U.K.[26] [27] Methane gas-fired power plants release an intense amount of pollution that harms the local communities and the planet. The footage provides further visual evidence that methane is emitted across the supply chain. The intense methane and VOC pollution released from production, processing, liquification, transportation and regasification of LNG is accelerating climate change and causing health impacts to local communities.

The video evidence undercuts Japan's efforts to greenwash LNG and gas. The public can now witness the harmful methane emissions released from LNG infrastructure in Japan.

Japan must stop expanding LNG

Current plans by the Japanese and U.S. governments to expand LNG production and consumption are motivated primarily by the desire to increase corporate profits. In Japan, LNG demand has been falling and is projected to continue to decline. During 2023, Japan resold more LNG than it purchased from Australia, its largest LNG supplier.[28]

Despite concerns that Japan spends a tremendous amount of money to purchase foreign fossil fuels, the Japanese Cabinet approved the 7th Strategic Energy Plan, which emphasizes LNG for energy "transition" and energy security.[29] However, Japan's reselling of LNG and falling LNG demand make it clear that Japan does not need additional LNG for domestic use.

Our research shows that LNG is dirty across the supply chain – Japanese domestic LNG import terminals and gas plants are no exception. We documented significant methane emissions from the Futtsu LNG import terminal, Futtsu gas power plant, and the Goi LNG power plant. Stopping the development of new gas infrastructure and transitioning to renewable energy is critical to meeting climate goals and avoiding the worst impacts of the climate crisis.

Japan is undermining the energy transition and fueling the climate crisis with its support for gas and LNG. Japan is trading away a liveable future for future generations for short-term corporate and economic gain. The Japanese government and private banks **must stop financing** all LNG and gas infrastructure, including LNG export and import terminals, power plants and extraction.

APPENDIX - Technical Assessment and OGI Peer Review

A. Futtsu LNG regasification plant

This very effective site-wide OGI compilation recorded from a boat documents some industrial steam that was visible to the bare eye, but it was insignificant when compared to the massive ground-based methane emissions that lofted over the horizon over and around a storage tank battery and some vertical exhaust stack releasing uncombusted/partially combusted emissions that became approximately ambient temperature within feet after being released, none of which were visible to the bare eye.
James Tim Doty, Level III thermographer

B. Futtsu Thermal Power Plant

This OGI video documents two matching tall vertical stacks that were surrounded by exterior supports and one shorter rectangular stack that were actively releasing heated uncombusted/partially combusted emission plumes that were not visible to the bare eye and became approximately ambient temperature within feet after being released.
James Tim Doty, Level III thermographer

C. Goi LNG Power Plant

This OGI video documents three tall vertical and spiraled stacks continuously releasing heated uncombusted/partially combusted emissions that were not visible to the bare eye and became approximately ambient temperature within some 1/2 stack height after being released, along with uncombusted/partially combusted heated emissions being released from two apparent rooftop exhaust stacks, as the plumes became approximately ambient temperature within feet of being released.
James Tim Doty, Level III thermographer

ENDNOTES

1. Oil Change International. "G20 public money enabled 82% of LNG export infrastructure expansion, breaking climate promises," 2023.
2. Oil Change International. "Japan's fossil finance threatens to derail the energy transition in Asia and globally," November 2023.
3. Sierra Club U.S. LNG Export Tracker. As of June 27, 2025, Japanese private and public institutions provided $ 44,380 million for U.S. LNG export projects. https://www.sierraclub.org/dirty-fuels/us-lng-export-tracker
4. Viktor Tachev, "Japan To Buy 'Record Amounts' of LNG From US After Trump and Ishiba Meet," Energy Tracker Asia, February 25, 2025. https://energytracker.asia/japan-to-buy-record-amounts-of-lng-from-us-after-trump-and-ishiba-meet/
5. Melisa Cavcic, "$3 billion loan in the bag for Venture Global's $28B US LNG export project in Louisiana," Offshore Energy, May 5, 2025. https://www.offshore-energy.biz/3-billion-loan-in-the-bag-for-venture-globals-28b-us-lng-export-project-in-louisiana/
6. "Japanese energy company signs deals with US natural gas producers," Washington Examiner, June 11, 2025.
7. Sierra Club U.S. LNG Export Tracker. https://www.sierraclub.org/dirty-fuels/us-lng-export-tracker
8. Information on the Project [23-007]. Nippon Export and Investment Insurance. https://www.nexi.go.jp/en/environment/a/2023051502.html
9. Lan, X., K.W. Thoning, and E.J. Dlugokencky: Trends in globally-averaged CH4, N2O, and SF6 determined from NOAA Global Monitoring Laboratory measurements. Version 2025-06, https://doi.org/10.15138/P8XG-AA10
10. Lan, X., K.W. Thoning, and E.J. Dlugokencky: Trends in globally-averaged CH4, N2O, and SF6 determined from NOAA Global Monitoring Laboratory measurements. Version 2025-06, https://doi.org/10.15138/P8XG-AA10
11. IEA (2024), Global Methane Tracker 2025, IEA, Paris, https://www.iea.org/reports/global-methane-tracker-2025.
12. IEA (2024), Global Methane Tracker 2025, IEA, Paris, https://www.iea.org/reports/global-methane-tracker-2025.
13. Sherwin, E.D., Rutherford, J.S., Zhang, Z. et al. "U.S. oil and gas system emissions from nearly one million aerial site measurements". Nature 627, 328–334, 2024. https://www.nature.com/articles/s41586-024-07117-5
14. U.S. Department of Energy, Energy Information Administration, Drilling Productivity Report. https://www.eia.gov/petroleum/drilling/
15. Chen, Y., et al. 2022. Quantifying Regional Methane Emissions in the New Mexico Permian Basin with a Comprehensive Aerial Survey. Environmental Science & Technology, March 23. https://pubs.acs.org/doi/10.1021/acs.est.1c06458
16. Zhang, Y., et al. 2020. Quantifying methane emissions from the largest oil-producing basin in the United States from space. Science Advances, April 22. https://www.science.org/doi/10.1126/sciadv.aaz5120
17. Cathy Landry, "Congress kills Biden-era methane fee," Oil and Gas Journal, March 4, 2025. https://www.ogj.com/general-interest/government/article/55272282/congress-kills-biden-era-methane-fee
18. Robert W. Howarth "The greenhouse gas footprint of liquefied natural gas (LNG) exported from the United States," Energy Science & Engineering, October 3, 2024. https://scijournals.onlinelibrary.wiley.com/doi/10.1002/ese3.1934
19. Federal Register, "2024 LNG Export Study: Energy, Economic, and Environmental Assessment of U.S. LNG Exports," 2024. https://fossil.energy.gov/app/docketindex/docket/index/30
20. U.S. Department of Energy (12.17.2024) Statement from U.S. Secretary of Energy Jennifer M. Granholm on Updated Final Analyses. https://www.energy.gov/sites/default/files/2024-12/Statement%20from%20U.S.%20Secretary%20of%20Energy%20Jennifer%20M.%20Granholm%20on%20Updated%20Final%20Analyses_12.17.2024.pdf
21. "Cutting emissions of potent but short-lived greenhouse gas methane is 'emergency brake'," The Guardian, November 19, 2024. https://www.theguardian.com/environment/live/2024/nov/19/cop29-climate-summit-live-updates-world-leaders-in-baku-azerbaijan
22. IEA (2024), Global Methane Tracker 2025, IEA, Paris, https://www.iea.org/reports/global-methane-tracker-2025.
23. IEA (2024), World Energy Outlook 2024, IEA, Paris. https://www.iea.org/reports/world-energy-outlook-2024
24. "Top ten active LNG regasification terminals in Asia," Offshore Technology, August 5, 2024. https://www.offshore-technology.com/data-insights/top-ten-active-lng-regasification-terminals-in-asia
25. "Japan's Jera gets 4000th LNG cargo at Futtsu terminal," LNG Prime, April 24, 2024. https://lngprime.com/asia/japans-jera-gets-4000th-lng-cargo-at-futtsu-terminal/110478/
26. "Investigative journalism: New Century File 7: Blind spots in climate change measures," NHK, November 30, 2024
27. Centrica Energy Peterborough Natural Gas Power Station, Cambridgeshire, England (February 2019), OGI footage. https://www.youtube.com/watch?v=ZtmDRyxdZd0&list=PL9BS7nDf-8tr5p1OQPTTXfdLU55d_HfEe
28. Institute for Energy Economics and Financial Analysis. "How Japan cashes in on resales of Australian LNG at the expense of Australian gas users," May 20, 2025.
29. "The 7th Strategic Energy Plan," Agency of Natural Resources and Energy, February 2025. https://www.enecho.meti.go.jp/en/category/others/basic_plan/pdf/7th_outline.pdf