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Dominion Study Confirms Climate Risks of "Lifecycle" Methane Leakage from Exporting Liquefied Natural Gas

Policy and Infrastructure Uncertainty Calls into Question the Pollution Status of Cove Point

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Summary

A study commissioned by Dominion Resources has finally and explicitly confirmed that any evaluation of global warming pollution from liquefied natural gas exports must assess the "leakage" of methane throughout the full natural gas "lifecycle" process. In the context of Dominion's proposed $3.8 billion Cove Point export project in southern Maryland, Dominion has for months failed to acknowledge that global warming pollution occurs beyond the end-point combustion, thus failing to account for drilling, piping and other means of pollution in the full gas process. Environmental groups and other critics have repeatedly pointed out Dominion's heretofore omission of full pollution emissions. But now, finally, a report commissioned by Dominion itself confirms the full pollution potential triggered by Cove Point exports. This study represents a breakthrough in finally allowing the public and elected officials to judge the merits of the project as well as possible pollution mitigation efforts and possible alternatives.

Unfortunately, the Dominion-commissioned study itself goes onto draw overly optimistic conclusions based on an incomplete review of the evidence. However, when the assumptions about methane emissions from the Dominion study are overlaid with a recent report released by the U.S. Department of Energy, it becomes clear that LNG exported from Cove Point would be as least as bad for the climate as foreign coal if exports began today. Fortunately, by accepting lifecycle science as the starting point for discussing the climate change impacts of LNG, the discussion with Dominion and the rest of the gas industry is now finally and firmly focused exactly where it should be, which is "what is the methane leakage rate?" and "how can we keep it as low as possible?" and "can we really address global warming while expanding fossil fuels?" Under a rational policy regime, this would presumably lead Dominion to work with its supply chains to transparently and verifiably reduce methane leakage to as close to zero as possible – using cost-effective and EPA-certified technologies that exist today – thus offering the best

opportunity for climate benefits. But given the current regulatory and infrastructure uncertainties around the natural gas supply chain leaks, this multi-billion dollar Cove Point expenditure would be better invested in truly clean fuel sources like efficiency, wind, and solar energy.

Introduction

Dominion Resources recently commissioned a study from ICF International to examine the lifecycle greenhouse gas (GHG) emissions of exporting liquefied natural gas (LNG) from Cove Point, MD.[1] Importantly, the study highlights the need to account for methane leakage throughout the entire natural gas lifecycle when comparing GHG emissions from LNG versus coal. Natural gas is 80 to 98 percent methane, and methane is approximately 86 times as potent a greenhouse gas (GHG) as carbon dioxide over a 20-year timeframe. Each pound of methane leaked into the atmosphere reduces natural gas's greenhouse gas advantage over coal.

Focusing on lifecycle methane leakage is an important, if belated, step for Dominion. Previous statements from the company have touted the GHG benefits of replacing coal with natural gas, but have only focused on emissions at the point of combustion while ignoring all the upstream emissions that take place prior to combustion. Thankfully, the ICF report now contends that natural gas offers climate benefits over coal ***only*** when methane leakage is acknowledged and reduced to acceptable levels.

Dominion and CCAN still disagree on the current magnitude of methane leakage domestically and abroad. Based on a review of available methane research, CCAN and many other environmental groups and experts believe that lifecycle methane leakage in the U.S. and abroad may be much higher than ICF and EPA estimates. Absent enforceable standards to ensure the use of proven, cost-effective leakage reduction technologies, lifecycle methane leakage rates may be well in excess of the threshold that would make Cove Point LNG safer for the climate than coal.

At a time when greenhouse gas levels in the atmosphere are higher than at any other time in human history and when Maryland has committed to one of the strongest greenhouse gas reduction goals in the country, public officials should be asking for a higher standard from the energy sector. Absent a national and international framework to rapidly deploy carbon-free energy to prevent global temperatures from rising above the accepted 2°C target – which is ultimately needed to address climate change – Dominion should work with its supply chains to meet the maximum emissions abatement potential based on technologies that exist today.

Leakage Must Stay ***Well Under*** 1.4% for LNG to Reduce Greenhouse Gas Emissions Relative to Coal

The subject of lifecycle methane leakage has taken on new prominence as America's hydraulic fracturing, or fracking, boom has driven a surge of U.S. natural gas production.

A team of researchers from the Environmental Defense Fund, Princeton University, Rochester Institute of Technology, and Duke University tried to quantify the climate "break-even" point for lifecycle methane leakage from domestically produced and consumed natural gas in a 2012 paper published in the *Proceedings of the National Academy of Sciences* (PNAS).[2] They concluded that

new natural gas combined cycle power plants reduce climate impacts compared to new coal plants only when leakage remains under 3.2%. They also found that leakage would have to remain below 1% in order to have an immediate climate benefit compared to all other fossil fuel technologies, such as fuel switching from diesel engines to compressed natural gas engines in heavy duty vehicles. Since its release, the study's leakage "break-even" thresholds have been endorsed by the state of Maryland[3] and the International Energy Agency.[4]

Since the release of that 2012 PNAS paper, the Intergovernmental Panel on Climate Change released its *5th Assessment Report*, which found that methane is more potent as a greenhouse gas than they had previously estimated. The report increased the global warming potential (GWP) of methane over a 20-year time period by 19%, from 72 times more potent than carbon dioxide to 86 times as potent when accounting for climate-carbon feedbacks. The new science on methane potency led the lead author of the 2012 PNAS paper, Ramón Alvarez from the Environmental Defense Fund, to revise downwards the methane "break-even" thresholds to 2.7% when fuel switching from coal to natural gas, and 0.8% when fuel switching from diesel engines to compressed natural gas engines in heavy duty vehicles.[5]

What that means for Cove Point

Notably, the 2.7% leakage threshold only applies to domestically produced and consumed natural gas. The U.S. DOE reports that "compared to domestically produced and combusted gas, there is a significant increase in the life cycle GHG emissions that are attributed to the LNG supply chain, specifically from liquefaction, tanker transport, and regasification processes."[6]

When the report quantified how much lower the methane breakeven threshold has to be when comparing the climate impacts of LNG to coal-fired electricity, DOE found that lifecycle methane leakage would have to stay below 1.4% when exporting LNG to Asia in order to have any net climate benefit over the first 20 years. In other words, lifecycle methane leakage for LNG exported to Asia has to be significantly lower than domestically produced and consumed natural gas just to break even with the lifecycle emissions of regional coal-fired electricity abroad.

The lifecycle leakage rate of the Cove Point project has to be very low in order to realize any greenhouse gas reduction benefits from natural gas. A full accounting of the lifecycle greenhouse gas emissions of Cove Point's natural gas should also account for pipeline leakage in Japan and India. Such an analysis, based on a full accounting of foreseeable methane leakage and foreseeable offset fuels abroad, should form the basis of analyzing whether or not Cove Point will cause significant harm to the climate.

There is Evidence that U.S. and Foreign Leakage Rates are Higher than 1.4 Percent

Both CCAN and Dominion's report from ICF assert that the lifecycle leakage rate has to be low in order to realize any greenhouse gas reduction benefits from natural gas. In their analysis of Cove Point, however, ICF only analyzed the lowest published leakage rate estimate from the EPA – 1.4% – before concluding that Cove Point's LNG would reduce global GHG emissions. What's more, since the issuance of Dominion's report, DOE defined 1.4% as the break-even threshold when LNG is as dangerous for the climate as coal over the critical 20-year timeframe.

A more robust analysis would have considered a range of U.S. leakage rates from other published studies. A full accounting of the lifecycle greenhouse gas emissions of Cove Point's natural gas should also account for pipeline leakage in Japan and India.

The fact is that there remains a high degree of uncertainty about the magnitude of methane leakage both in the U.S. and abroad. Without standards in place to monitor leakage rates and adequately-funded enforcement mechanisms to keep them low, it is impossible for Dominion or anyone else to say definitively that LNG would be better for the climate than coal or oil.

U.S. EPA may be Underestimating Domestic Natural Gas Leakage

Taken together, a recent body of work in the field of methane leakage provides a series of case studies from around the country highlighting the range of methane leakage throughout the natural gas lifecycle. These studies show that some fracking operations can leak orders of magnitude more than official estimates suggest, that there is an urgent need for better leakage data, and that swift action should be taken to prevent methane leakage wherever possible.

Below is a summary of recent studies about methane emissions during the natural gas lifecycle. For a more comprehensive analysis recent leakage studies, see CCAN's white paper: *U.S. Methane Leakage from Natural Gas Systems: A Literature Review*.[7]

Toward a better understanding and quantification of methane emissions from shale gas development[8] - Published in *Proceedings of the National Academies of Science* in April 2014 by researchers from National Oceanic and Atmospheric Administration, Cornell University, Pennsylvania State University, and University of Colorado, Boulder. The study directly measured methane emission from fracked wells in the Southwestern Pennsylvania Marcellus shale region. Measured emissions from several well pads were 2 to 3 orders of magnitude (100 - 1,000 times) greater than EPA estimates. Furthermore, the well pads were measured during the drilling process, prior to gas flow stimulation, which is a preproduction stage not previously associated with high methane emissions. *The authors conclude that "high fugitive emission rates are likely to be a national-scale issue, although the mechanisms of these fugitive leaks may be different at each site." They also said that recent regional and national findings "indicate that overall sites leak rates can be higher than current inventory estimates," and that "high leak rates illustrate the urgent need to identify and mitigate these leaks as shale gas production continues to increase nationally."*

Methane emissions estimates from airborne measurements over a western United States natural gas field[9] - Published in the journal *Geophysical Research Letters* in August 2013 by researchers from the National Oceanic and Atmospheric Administration and the University of Colorado, Boulder. Measured natural gas production in Uintah County, Utah and found leakage rates between 6% and 12% of production. This emissions estimate is 1.8 to 38 times inventory-based estimates from this region and five times the US EPA nationwide average estimate of leakage from the production and processing of natural gas. The authors conclude by saying:

"[Our study is] the first atmospheric measurement-based estimate of methane emissions from a producing gas and oil field to date that does not rely on atmospheric transport models or bottom-up inventory information. Such independent verification of inventory-based estimates is essential

for evaluating inventory methodologies, quantifying the effectiveness of future regulatory efforts, and accurately determining the climate impact of natural gas over other fossil fuels."

Methane Leaks from North American Natural Gas Systems[10] - Published in the journal *Science* in February 2014 by researchers from Stanford University, Harvard University, MIT, the National Oceanic and Atmospheric Administration, the National Renewable Energy Laboratory, University of Michigan, Ann Arbor, University of Colorado, Boulder, University of Calgary, Lawrence Berkley National Laboratory, University of California, Santa Barbara, and the Environmental Defense Fund. The report reviewed 20 years of technical literature on natural gas emissions in the United States and Canada. The authors estimated that regional atmospheric studies with very high emissions rates are unlikely to be representative of typical natural gas system leakage rates, but goes on to say that EPA is probably underestimating gas sector methane emissions by 50%. *The authors conclude that "improved inventory validation is crucial to ensure that supplied information is timely and accurate," and that "diligence will be required to ensure that leakage rates are low enough to achieve sustainability goals"*

Methane and the greenhouse-gas footprint of natural gas from shale formations[11] **-** Published in the journal *Climate Change Letters* in June 2011 by researchers from Cornell University. This study relied primarily on a 2010 technical greenhouse gas reporting document submitted by the petroleum and natural gas industry to the EPA and a 2010 report from the Government Accountability Office about federal oil and gas leases. The authors estimate that "3.6% to 7.9% of the methane from shale-gas production escapes to the atmosphere in venting and leaks over the lifetime of a well," which is "at least 30% more than and perhaps more than twice as great as those from conventional gas." *The authors conclude that "compared to coal, the footprint of shale gas is at least 20% greater and perhaps more than twice as great on the 20-year horizon and is comparable when compared over 100 years."*

Measurements of methane emissions at natural gas production sites in the United States[12] – Published in the *Proceedings of the National Academies of Science* in September 2013 by a study team led by University of Texas, URS, and Aerodyne Research in collaboration with an the Environmental Defense Fund and nine natural gas producers – Environmental Defense Fund (EDF), Anadarko Petroleum Corporation, BG Group plc, Chevron, Encana Oil & Gas (USA) Inc., Pioneer Natural Resources Company, SWEPI LP (Shell), Southwestern Energy, Talisman Energy USA, and XTO Energy, an ExxonMobil subsidiary. This paper studied the production stage of fracking through direct measurements of methane emissions at 190 onshore natural gas sites in the United States. Those sites were selected by the participating companies, and the researchers took measurements at times when the companies granted them access. *The study team concluded that "Estimates of total emissions are similar to the most recent EPA national inventory of methane emissions from natural gas production."*

The University of Texas study analyzed nine natural gas companies that volunteered to participate, out of thousands of producers in the U.S. Most of the participating companies also participate in EPA's voluntary Natural Gas STAR Program, where they work with EPA staff to reduce their methane emissions. **Given the early actions that these companies have taken to reduce their methane leakage, this study represents what could be done in the future by all well operators if they took similar leakage mitigation steps. But currently only a small**

number of operators have worked with the Natural Gas STAR Program to reduce leakage this way.

Foreign Leakage is Potentially Much Higher than U.S. Leakage

There are four distinct gas lifecycle stages that take place prior to combustion:

1.) Production
2.) Processing
3.) Transmission & Storage
4.) Distribution

In the case of Cove Point, the first two stages would take place in the U.S. It is therefore appropriate to use U.S. leakage estimates for production and processing. The last two stages however, would take place in either India or Japan, so we would need to know the leakage rates of their transmission and distribution pipelines to do a full lifecycle analysis of Cove Point's GHG emissions.

Unfortunately, we do not have leakage rates for Indian and Japanese pipelines. We do, however, know that the IPCC says that "developing countries and countries with economies in transition have much greater amounts of fugitive emissions per unit of activity (often by an order of magnitude or more)" compared to their North American and Western European counterparts.[13] This is particularly concerning because even some Western European countries like France and Ireland have leakage rates that make LNG worse for the climate, or nearly as bad, as coal, when combining EPA's conservative domestic leakage estimates with data published by the International Energy Agency.

The data below shows estimates of the leakage rates in high-import Western European countries, the United States, and developing countries and countries with economies in transition, like India. If the lifecycle leakage rate of LNG headed to importing Asian countries was as high as nearly all of these countries, the lifecycle emissions of that LNG would be almost certainly worse than coal, given the DOE says leakage must stay under 1.4%.

Country	Share of Country's Gas from Imports	Gas Loss Rate (mostly pipelines & compressors)	Increased Gas Losses Compared to U.S. pipelines & compressors	Lifecycle Leakage Rate if Imported from U.S. (based on 2011 EPA Inventory)	Lifecycle Leakage Rate if Imported from U.S. (based on Brandt, et.al., Science, February 2014)
United States	**NA**	0.7%	**NA**	1.4%	2.1%
Czech Republic	98%	1.8%	148%	2.5%	2.8%
France	99%	3.0%	318%	3.7%	4.1%
Italy	89%	0.5%	-24%	1.3%	1.6%
Hungary	76%	1.7%	144%	2.5%	2.8%
Greece	100%	0.4%	-43%	1.1%	1.5%

Ireland	93%	1.6%	125%	2.3%	2.7%

Average Pipeline & Compressor Gas Loss Rate (U.S., Czech Republic, Italy, Hungary, Greece, Ireland) (EPA and IEA, 2011)	1.4%
Scale-up Factor for Developing Countries and Countries with Economies in Transition (IPCC, 2006)	10
Estimated Pipeline & Compressor Gas Loss Rate (Developing Countries and Countries with Economies in Transition)	**14%**

The tables above were compiled using 2011 statistical data from the International Energy Agency and data from the IPCC.[13, 14] These countries were picked because of their high import rates which means that most or all of their lost gas comes from the transmission & storage and distribution stages.

A non-Cove Point example of how this could play out is Louisiana-based Cameron LNG, a proposed LNG export terminal that received conditional export approval from the U.S. Department of Energy. They have signed a 20-year contract with GDP SUEZ S.A. to ship 4 million tons per annum of LNG to France. By combining the IEA's French import leakage rate with U.S. EPA's conservative production and processing leakage rates, we can estimate that Cameron LNG's gas would leak at a 3.7% rate. By scaling up U.S. EPA's production and processing leakage rates by 50% as per the findings of Brandt, et. al. in their 2014 article in *Science*,[10] we can estimate that Cameron LNG's gas would leak at a 4.1% rate.

In light of the DOE's latest report, it is reasonable to conclude based on IEA data that LNG exported from the U.S. to France would be immediately worse for the climate than coal on day 1. What's more, the IPCC ominously warns that the methane leakage problem could be at least ten times worse in developing nations like India that would be importing LNG from Cove Point.

Robust Standards are Necessary to Reduce Leakage

The body of science to-date shows that methane leakage rates can vary greatly depending on the specifics of each gas operation. But absent the use of proven, cost-effective technologies and practices to reduce methane emissions, those leakage rates can be ***very*** high. Several studies have measured methane concentrations near U.S. well sites that estimate leakage rates well in excess of the threshold that makes domestic natural gas safer for the climate than coal. This problem is compounded by the fact that certain Western European nations could have higher pipeline leakage rates than the U.S., and that the IPCC warns the problem may be much worse in "developing countries and countries with economies in transition."

Until standards are in place that can ensure that all avoidable methane leakage from the natural gas lifecycle will be prevented, it is difficult to see how Cove Point's LNG could be safer for the climate than the coal it might displace.

Preventing Methane Leakage with EPA-certified Prevention Measures

The ICF report correctly points out that there are many cost-effective methods of reducing methane emissions. In fact, since 1993, EPA has run the Natural Gas STAR Program, a voluntary partnership that encourages oil and natural gas companies - both domestically and abroad - to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce methane emissions.

The Natural Resources Defense Council (NRDC)[15] and the World Resources Institute (WRI)[16] estimate that simply adopting a list of ten identified cost-effective technologies and practices could reduce lifecycle natural gas leakage to 0.4 percent. According to EPA STAR Program data, most of these top ten technologies and practices have payback periods of less than one year because they allow companies to capture and sell gas that would otherwise be leaked into the atmosphere. After that rapid payback period, each one of these recommendations would generate additional profits for the company.

Those technologies and practices are:

1. **Green Completions** to capture oil and gas well emissions.
    a. Payback time: 0.17 – 1.0 year
    b. Profit per well (after payback): $2,180 - $75,620

2. **Plunger Lift Systems** or other well deliquification methods to mitigate gas well emissions.
    a. Payback time: 0.09 - 0.13 years
    b. Profit per well (after payback): $7,050 - $100,400

3. **Tri-Ethylene Glycol (TEG) Dehydrator Emission Controls** to capture emissions from dehydrators.
    a. Payback time: 0.09 years
    b. Profit per well (after payback): $135,560

4. **Desiccant Dehydrators** to capture emissions from dehydrators (when the gas flow rate is less than 5 MMcfd and have temperature and pressure limitations).
    a. Payback time: 2.67 years
    b. Profit per well (after payback): $2,800

5. **Dry Seal Systems** to reduce emissions from centrifugal compressor seals
    a. Payback time: 0.38 – 1.15 years
    b. Profit per well (after payback): $77,620 - $473,870

6. **Improved Compressor Maintenance** to reduce emissions from reciprocating compressors.
    a. Payback time: 0.34 – 4.81 years
    b. Profit per well (after payback): - $2,460 - $12,170

7. **Low-Bleed or No-Bleed Pneumatic Controllers** used to reduce emissions from control devices.
    a. Payback time: 0.09 – 0.5 years
    b. Profit per well (after payback): $510 - $1,880

8. **Pipeline Maintenance and Repair** to reduce emissions from pipelines.
    a. Payback time: 0.7 – 2.0 years
    b. Profit per well (after payback): -$39,870 - $53,800

9. **Vapor Recovery Units** used to reduce emissions from storage tanks.
    a. Payback time: 0.3 – 3.28 years
    b. Profit per well (after payback): $6,970 - $336,990

10. **Leak Monitoring and Repair** to control fugitive emissions from valves, flanges, seals, connections and other equipment.
    a. Payback time: likely small
    b. Profit per well (after payback): likely positive

In order to mitigate dangerous upstream methane emissions and lessen Cove Point's impact on the global climate, Dominion would need to require that its gas suppliers and gas customers participate in the EPA STAR Program. Dominion and the other companies it works with along its LNG supply chain would need to work with EPA STAR Program staff to implement those top ten control technologies and practices in order to both immediately reduce emissions and increase gas system profitability.

EPA New Source Performance Standards

In reference to the New Source Performance Standard (NSPS) regulations adopted by EPA in August 2013, ICF asserted that the U.S. EPA has promulgated new regulations to reduce methane emissions from several segments of the gas industry. That is not entirely accurate.

The new NSPS rule only covers volatile organic compounds (VOCs) – not methane – from new gas wells drilled after 2015. They decided instead to "continue to evaluate the appropriateness of regulating methane with an eye toward taking additional steps if appropriate."

In response to their failure to act, Maryland joined New York, Massachusetts, Connecticut, Delaware, Rhode Island, and Vermont in notifying EPA of their intention to sue in December 2012. **The states contend that while the NSPS standards will "have the incidental benefit of also reducing annual methane emissions by about 19 million metric tons CO2e, the vast majority of methane emissions from this sector will remain uncontrolled."**

EPA's NSPS rule is a step in the right direction, but it does not go far enough. The technology requirements only apply to VOCs and are not nearly as rigorous as the top 10 emissions abatement technologies identified by NRDC and WRI. The regulations will also only apply to new wells drilled after 2015, and will therefore not require any leakage reduction measures from the nearly 6,400 fracking wells that have already been drilled in Pennsylvania alone[17] that may be supplying gas to Cove Point.

Fighting Climate Change with Clean Energy

Ultimately, even if leakage could be reduced to zero, the IPCC still tells us that global greenhouse gas emissions will have to fall 40% to 70% by 2050 to prevent a catastrophic rise in global temperatures. In order to achieve that goal, they say that the world will need to initiate **"***more rapid improvements of energy efficiency, a tripling to nearly a quadrupling of the share of zero-and low-carbon energy supply from renewables, nuclear energy, and fossil energy with carbon dioxide capture and storage (CCS), or bioenergy with CCS."*[18]

This is particularly concerning for LNG exports because of the findings of the International Energy Agency's 2012 report that examined a "Golden Rules Case" for the future of natural gas.[4] This looked at rapid U.S. natural gas expansion – with LNG exports – where companies engage with policymakers, regulators, and others to address these environmental and social impacts of gas production. IEA found that *widespread expansion of natural gas at the global level, without a commensurate increase in clean energy, "puts CO_2 emissions on a long-term trajectory consistent with establishing the atmospheric concentration of GHG emissions at around 650 parts per million, a trajectory consistent with a probable temperature increase of 3.5 degrees Celsius (°C) in the long term, well above the accepted 2°C target."* That is because natural gas expansion would "lead to slightly higher overall consumption of energy and, in some instances, to displacement of lower-carbon fuels, such as renewable energy sources and nuclear power."[4]

Those dire warnings from the IPCC and IEA mean that rapidly expanding natural gas use around the world, without simultaneously pursuing a rapid expansion of carbon-free energy, has the dangerous potential to undermine any efforts to seriously address climate change. In order for Cove Point and other large natural gas infrastructure projects to even be considered, an enforceable policy framework putting the U.S. and other nations on a trajectory towards reducing GHG emissions 40% to 70% by mid-century, would have to be in place. Until such a framework is in place, any push towards expanding LNG exports would almost certainly exacerbate climate change.

Conclusion

ICF and CCAN have both reported that methane leakage throughout the natural gas lifecycle undermines the climate benefits of fuel switching from coal to LNG. Due to the greenhouse potency of methane, leakage throughout the LNG lifecycle would have to be kept as low as possible in order to reduce GHG emissions relative to other fossil fuels within a timeframe consistent with stabilizing global greenhouse gas emissions. Furthermore, warnings from the IPCC and IEA make clear that any moves to expand fossil fuel infrastructure should be preceded by a strategy to immediately and aggressively reduce GHG emissions with clean energy.

While ICF contends that leakage rates are already low, a number of studies cast that assumption into doubt. The body of science to date shows that methane leakage rates can vary greatly depending on the specifics of each gas operation. Furthermore, in light of the DOE's recent lifecycle GHG analysis of LNG exports, even the low leakage rate assumed by ICF would make Cove Point's LNG as dangerous for the climate as coal over a 20-year timeframe. Absent the use of proven, cost-effective technologies and practices to reduce methane emissions, leakage rates can be ***very*** high – well in excess of the threshold that makes domestic natural gas safer for the climate than coal.

Despite some positive first steps taken by the EPA, there remains no national framework in place to ensure low methane emissions from natural gas operations. There are also no global or national standards in place to ensure that a flood of cheap natural gas does not increase overall energy consumption and defer investments in lower-carbon fuels. In order for the gas industry to say confidently that their exports would not exacerbate global climate change, a policy framework would have to be in place to prevent all avoidable methane leakage while also ensuring that nations around the world accelerate their investments to rapidly deploy carbon-free energy to prevent global temperatures from rising above the accepted 2°C target.

Absent such a national and international framework, public officials should not support the Cove Point project unless and until Dominion works with its supply chains to transparently reduce methane leakage to *well below* 1.4% and as close to zero as possible. These methane reductions should be achieved and verified to the maximum extent using the latest leakage detection technologies and other cost-effective and EPA-certified technologies like those identified in this report – thus offering the best opportunity for climate benefits.

Policymakers who support any LNG exports prior to implementation of proven technologies to reduce methane leakage are accepting the very real – and perhaps likely – possibility that such exports are worse for the global climate than coal. The decision of whether or not to export LNG needs to be led by science, and it needs to take place in tandem with the formulation of a global strategy to reduce greenhouse gas emissions 40% to 70% by mid-century.

Given the current regulatory and infrastructure uncertainties around the natural gas supply chain leaks, this multi-billion dollar Cove Point expenditure would be better invested in truly clean fuel sources like efficiency, wind, and solar energy.

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