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The Climate Case for Expanding U.S. Natural Gas Exports

AN ISSUE BRIEF
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ISSUE BRIEF

A key question for current American climate, energy, and security policy is what role abundant U.S. natural gas should play in the ongoing domestic and global clean energy transition. This report finds that expanding U.S. natural gas production and exports can cut coal use, lowering domestic and global greenhouse gas emissions, along with other policies to increase renewable power and other forms of clean energy.

Studies consistently show that coal-to-liquefied natural gas (LNG) switching provides net greenhouse gas emissions reductions, usually between 40-50%, meaning the extent of global emissions reductions from coal displacement will be in part determined by how much U.S. liquefied natural gas reaches overseas coal-using nations.[1] In China, for example, coal emissions have grown by 15% over the last decade due to new coal-fired power plants, and data shows gas power plants have the potential to reduce Chinese emissions by up to 35%.[2]

Large reductions in coal emissions are urgently needed for climate protection. Last year, global coal consumption reached an all-time high, fueled by record coal output in China, India and Indonesia, the world's three largest producers.[3] Europe, facing sharp reductions in Russian natural gas, also increased coal consumption for the second year in a row,[4] and the U.S. still uses coal for 22% of its electricity.[5] Global coal-fired generation reached an all-time high in 2021, pushing CO_2 emissions from coal power plants to record levels.[6] These increases in coal use drove worldwide greenhouse gas emissions to record highs in 2022, belying any notion that current climate policies alone have been effective in rapidly reducing coal emissions.[7]

In addition, recent investigations by Bloomberg News have found that Chinese coal mines emit massive plumes of methane so large that they accounted for roughly a fifth of total global methane emissions from all oil, gas, coal, and biomass combined.[8] Such huge methane emissions from coal mining suggest that the overall greenhouse gas emissions footprint from China's coal industry is larger than previously understood, making the case for coal-to-gas switching in China and other coal-producing nations around the world even more compelling.

But to maximize the climate change benefits of American gas displacing coal at home and abroad, the U.S. must also pursue increasingly aggressive reductions of fugitive emissions of methane. Not only is methane a greenhouse gas 86 times more powerful than carbon dioxide in causing warming over the next two decades, but mitigation of methane is uniquely important for limiting near-term global temperature increases that are causing dangerous and expensive climate impacts.[9]

The good news is that ambitious new U.S. methane mitigation regulations from the Biden Administration, methane emission taxes, mitigation funding in recent legislation[10], and renewed efforts by industry can drive down fugitive emissions of methane from U.S. gas rapidly and far below recent levels.[11] Moreover, three-quarters of methane emissions can be mitigated with current technology, and half can be eliminated at zero net costs to the oil and gas industry.[12] [13] In contrast, estimates of methane emissions from Russian gas are at least 2.8% of total gas volume, and likely much higher, since Kremlin estimates are unreliable and deliberately misleading, and are not subject to any serious new mitigation efforts, making Russian gas worse than coal for the climate.[14]

The climate value of the U.S. shale gas revolution has been evident for many years. According to EIA data, coal to gas switching accounted for as much as 61% of the U.S. emissions reductions over the period 2005-2020.[15] More than 100 U.S. coal plants were converted to natural gas plants from 2011 to 2020.[16]

Meanwhile, abundant U.S. gas has lowered energy and heating prices for U.S. consumers and benefited American manufacturing, not to mention the large balance of payments benefits of revenue flowing into the U.S. from gas exports.[17] If the geopolitical value of U.S. gas was not already evident, Russia's war on Ukraine has dramatically illustrated its vital importance to America's allies. U.S. gas exports to Europe over eight months of 2022 tripled, as detailed recently by PPI's Elan Sykes, rapidly helping Europe move toward its new goal of shaking free of Vladimir Putin's energy blackmail, while keeping EU natural gas prices far lower than expected in the last several months.[18] [19] Indeed, U.S. gas supplies have now been credited with lowering overall European inflation, boosting the EU economy at a crucial moment.[20]

But Russia's war on Ukraine shows no signs of resolution, so increased U.S. LNG exports will continue to be crucial to Europe's emissions reductions for many years to come,[21] helping the EU further reduce its reliance on high-methane-leaking Russian natural gas while also limiting EU coal use.

Leading analysts like Kaushal Ramesh at Rystad Energy expect large growth in EU LNG demand from about 72mn tons a year in 2021, to more than 110mn tons each year from now until at least 2030.[22] Trevor Sikorski of Energy Aspects anticipates tight EU and global gas supply through 2025, and says that gas will play an EU role until 2040.

Similarly, expanding U.S. gas exports to fast-growing Asian nations and others around the world now primarily reliant on coal consumption can cut emissions and help prevent Russia from dominating new global gas export markets.[23] Economic growth in the region, particularly in China and India, is expected to drive demand for a wide range of energy sources, including natural gas. Due to low lifecycle emissions of methane, U.S. liquefied natural gas delivered to China has, on average, at least 30% lower lifecycle greenhouse gas emissions than Chinese coal does, and according to many measures, U.S. LNG has about 50% less or even lower lifecycle emissions than older Chinese coal-fired plants.[24] A similar industry study finds a 48% emissions reduction.[25]

A private study by a leading environmental organization finds that net reductions from existing coal-fired power plants in Vietnam switching to U.S. LNG would be about 40%. Research by EQT, a leading U.S. gas supplier, finds that replacing older coal plants in Vietnam with Northeastern Pennsylvania gas would result between 53% and 58% life-cycle net emissions reductions.[26] The EQT analysis finds that U.S. LNG is currently replacing ~900,000 tons of international coal per day. As noted, IEA finds in general that coal-to-gas switching reduces emissions by 50%.[27]

On this basis, we argue that Asia should not only increase its use of natural gas to displace coal, but do so particularly by purchasing LNG imports from the United States and other lower methane-emitting sources, rather than sourcing natural gas from Russia.[28] We find that lower methane emissions gas systems give the United States a significant competitive advantage versus other sources of gas, an advantage that is likely to grow as the U.S. institutes ever more stringent methane regulations.

U.S. proven natural gas reserves are massive and can accommodate large increases in domestic and global use for several decades, to help reduce coal domestically and globally.[29] But as a practical matter, large increases of U.S. LNG exports will require even larger domestic production increases so that domestic gas prices stay low and popular political support for exports continues. Studies show that the U.S. can dramatically increase gas exports and production for more than two decades during the clean energy transition while keeping domestic prices low, at roughly $3 per million British thermal unit (MMBtu), which is likely to be the benchmark for cost-effective production in the long term.[30] Additional U.S. gas production will be needed to meet growing EU demand of perhaps 7 billion and 8 billion cubic feet per day (bcfd) demand in the next three to five years, but can offer export prices of less than $8/MMBtu, compared to recent peak European gas prices of $40 to $70/MMBtu.[31]

But this will require expanding U.S. natural gas infrastructure, including gas pipelines, LNG export terminals, and other facilities as part of an overall energy deployment policy based on permitting reform, which will provide even greater benefits to renewable energy. In particular, the U.S. should prioritize efforts to provide pipelines and other infrastructure to bring low-cost Appalachian gas to domestic and international markets, helping to limit inflation. All of this suggests that along with unprecedented U.S. incentives for other forms of cleaner energy passed in major bills over the last two years, American policymakers should now add the climate change benefits of expanding U.S. gas production and exports to the already strong geopolitical and domestic economic case for greater gas production in the near-term.

Indeed, the combination of a huge build-out of American clean energy technologies and low-emitting natural gas puts the U.S. in a uniquely enviable position to both dramatically reduce its domestic greenhouse gas emissions and help catalyze major global greenhouse gas reductions, in effect becoming a clean energy superpower. The U.S. will increasingly export not only natural gas, but also key technologies like carbon capture and storage (CCS) and electricity storage, and others. CCS, in particular, will be necessary for economies around the world to not just limit emissions from natural gas power plants, but to decarbonize heavy industries like steel, cement, aluminum, and other sectors that make up roughly 20% of U.S. and global carbon dioxide emissions. Advances in using CCS in natural gas plants can play a role in this process, especially if industrial use brings down costs. Overall, one can imagine a sustainable U.S. system in which enewable energy, electric vehicles, electricity storage, nuclear power, hydropower, and natural gas with carbon capture create a near-or-net-zero emissions energy economy well before 2050.

Yet, ironically, some left-leaning climate advocates oppose coal-to-natural gas fuel switching, even as worldwide coal consumption has continued to grow. These doctrinaire advocates insist on grouping coal and natural gas together as sources that must be immediately curtailed, despite the fact that gas displaced roughly half of U.S. coal in the last 15 years, and coal-to-gas switching was responsible for more than 60% of U.S. emissions cuts during that period. It's time honest climate advocates faced a fundamental fact: Natural gas production can have a crucial role in a successful global climate and clean energy transition, especially in the near-term. Indeed, it seems clear that as a practical economic and geopolitical matter, the greatest extent of near-term climate progress cannot be made without gas (along with renewable power) helping to balance electricity grids and rapidly phase out coal, in the West, in Asia, and elsewhere.

At the same time, small but vocal elements on the political right are in denial about the need to deeply and quickly cut methane emissions from natural gas (and, over time, CO_2) so that gas can reduce emissions to the greatest extent possible. But analysis consistently finds that both coal-to-gas switching and deep methane cuts must take place to maximize the economic, geopolitical and climate value of overall U.S. energy approaches. Policymakers should ignore these ideological, not factual, appeals emanating from both fringes of the political debate.

In the next two decades much more electric power will be needed in America and globally. Electricity demand will grow significantly, in part due to the electrification of transportation through the adoption of electric vehicles, which could raise U.S. electric power demand alone by as much as 38%.[32] One underappreciated advantage of natural gas power plants is their ability to provide rapid onset baseload power to balance electric grids increasingly dependent on intermittent renewable energy, with gas plants able to cycle up to full power within five or 10 minutes, providing synchronicity with renewable energy. In contrast, other forms of baseload power like nuclear and coal plants take far longer to deliver power to the grid when the sun stops shining and the wind stops blowing. Natural gas-fired plants that operate in a combined-cycle configuration are more efficient than coal-fired plants, producing electricity with significantly less energy input than coal, helping to further lower CO_2 emissions.

But U.S. gas must continue to dramatically reduce emissions of both methane and carbon dioxide. As new methane detection technologies are deployed, the U.S. gas industry will be able to prove that American natural gas can achieve among the lowest emissions of methane of any gas exports in the world, gaining a competitive advantage over higher-leaking systems and rival exports like those from Russia. Currently, many gas-importing nations, especially in Europe, are skeptical of large methane emissions reductions achieved by the U.S. in recent years. Such a competitive advantage of proving low fugitive emissions of methane from U.S. gas should also jumpstart global efforts by other major gas exports to limit methane leaks from their gas exports, as importers favor lower methane-leaking gas.

This “race to cut methane” can greatly increase the climate benefits of using gas to displace higher-emitting coal globally, and has already begun as evidenced by methane emissions reductions programs by major gas exports like Qatar. More rapid adoption of carbon capture technologies on gas fired power plants will be needed to cut overall GHG emissions from gas.

Total U.S. LNG exports increased only slightly in the first eight months of 2022, since short-term capacity is largely fixed, so the main way that gas shipments to the EU increased involved exporters redirecting shipments away from other destinations, mainly Asia. Europe received 23% of U.S. LNG in 2021, but 54% through August of 2022.[33] Of course, a main reason U.S. LNG was redirected to Europe was the higher price, with European spot natural gas prices often running several times those in other markets, including Asia. But for now, thanks in part to U.S. LNG, European prices have moderated.

In 2022, U.S. exports of natural gas as LNG rose 8% to 10.6 bcfd, just behind Australia's 10.7 bcfd. The United States remained ahead of Qatar, which in third place shipped 10.5 bcfd.,[34] though the U.S. is set to take the global lead on LNG exports early in 2023.

Overall, the U.S. gas industry is forecast to produce approximately 100 bcfd in 2023, so exports are likely to be somewhat more than 10% of national production.

Total U.S. LNG exports are expected to rise in 2023, although by how much is uncertain, as major new export facilities are not expected to reach full output until 2025.

The long-term role of gas beyond this decade is less clear. It may turn out that over the coming years renewable energy will continue to see dramatic price reductions making it far cheaper than other sources, although renewable energy would still need to be built more quickly and at tremendous scale. And other technologies like electricity storage may see advances that allow for electric grids to absorb greater amounts of intermittent renewable energy. But these developments are also uncertain. What is clear is that both the U.S. and EU have used gas to displace coal in large amounts, and to stabilize their electric grids to use more renewable energy, while much of the rest of the world has not. That presents a near-term opportunity for U.S. LNG exports to reduce global coal use significantly, limiting emissions in the process.

The policy question for America is: Can and should the U.S. systemically produce and export more gas to reduce domestic and global emissions? This study suggests the answer is emphatically: Yes. But achieving the security, economic, and climate benefits from increased gas production will require additional actions by the U.S., the industry, our allies, and even coal-consuming nations. To gain these benefits from increased gas production and exports, this report recommends the following policy actions.

POLICY RECOMMENDATIONS

Increase Domestic Gas Production

The United States should increase natural gas production substantially to allow for expansion of exports to Europe, Asia, and other markets through this decade, while at the same time keeping domestic natural gas prices low to help U.S. consumers, America's industrial economy, and further phasing out of domestic coal. The precise size of U.S. gas production and export increases will be dependent on a range of market, gas price, regulatory, and investment factors, but a national goal of increasing overall gas production from 2022 levels by 2028 is achievable and in U.S. economic, security, and climate interests. For example, to account for a doubling of new LNG exports, U.S. overall gas production would expand by about 10%.

Double U.S. Gas Exports

Internationally, the U.S. should increase LNG export levels as an explicit goal of U.S. policy, as articulated by President Joe Biden in 2021, specifically to help Europe end its dependence on Russian gas and help the EU reduce their dependence on high-emitting coal. The U.S. should also increase LNG exports to many other coal-dependent nations, including China, to encourage coal-to-gas switching as a critical element in reducing overall global greenhouse gas emissions. The total size of U.S. LNG export growth will be in part dependent on natural gas prices in Europe, Asia, and elsewhere. But given new LNG export facility construction, we propose an overall U.S. goal of doubling LNG exports over 2022 levels by 2028, in keeping with increases in total U.S. gas production with some of that increase going to phase out domestic coal more quickly. Today the U.S.

has six major LNG export terminals. Three new U.S. LNG export facilities now under construction will be at full output by 2025, and provide about half the LNG needed to meet the doubling goal. But several additional export facilities would still need to be built or existing exports expanded.[35] The U.S. Energy Information Agency expects U.S. LNG exports to increase 65% by 2033.[36]

Retire Coal Plants More Quickly

The U.S. should increase the pace of unabated coal-fired power plant retirements (coal still provides 22% of U.S. electricity) as a climate policy priority, using all available methods, including new power plant emissions regulations, increased energy efficiency, renewable energy, nuclear and hydropower, and coal-to-natural gas switching; the latter which has been responsible for well over half of U.S. emissions reductions since 2005.

Improve Gas Infrastructure

Meeting these objectives will require significant new investments in and permitting of U.S. natural gas pipelines and export facilities, as well as broader energy permitting reforms that will benefit renewable energy, gas, long-distance, high voltage electric power lines, and other elements of America's clean energy infrastructure. U.S. policy should encourage all of these investments consistent with broader U.S. decarbonization and clean energy goals.

Cut Life Cycle Methane Emissions from Oil and Gas to 0.3%

The U.S. should adopt a national goal of driving down lifecycle methane emissions from domestically-produced gas to less than 0.3% of overall gas volume by 2030, from about 1.7% in recent years, so that U.S. gas has demonstrably the lowest methane emissions in the world.[37] New methane detection technologies in the U.S. can help prove these reductions. Overall, the net cost of such mitigation is low, and will be more than made up for on a national level by revenue from increased LNG exports.

Set Goal of Zero-Net Emissions from Gas by 2040

The U.S. should also embrace a goal of near-zero methane emissions by 2040, as well as net-zero carbon dioxide emissions from U.S. natural gas power plants by 2040, through carbon capture and storage, hydrogen, direct air capture, and other technologies.

Establish Accurate Global Methane Emissions Data Center

OECD nations should within two years establish a definitive, accurate inventory of methane emissions from major natural gas producing and exporting countries, to improve on the current situation in which wildly differing methane data are offered by governments, industry, and NGOs, each with their own agendas and methods. It is in the interest of the U.S. that such definitive and accurate methane emissions data numbers be derived, since U.S. methane emissions are far lower than many other global exporters, specifically Russia, and falling rapidly. New satellite, drone, and other methane detection technologies should allow the accumulation of accurate statistics regarding methane emissions in the next year or two if needed investments are made. The International Energy Agency could be one organization considered to act as a clearinghouse for such accurate methane emissions data.

Urge Gas-Importing Nations to Establish Methane Emissions Content Standards

As accurate methane data is established, major gas-importing regions like the EU should establish methane emissions regulations for all gas imports, driving the global system toward stringent methane standards to make gas even more beneficial to the climate while freezing out Russia's antiquated, leaky system, and in the long-run forcing it to reform.

NOTE TO READERS

PPI will be releasing additional Issue Briefs on key topics supporting these recommendations in the next few weeks, including on:

- *Entrenchment of Global Coal Power Locks in Record Global Emissions*
- *Europe's Continuing Need for U.S. LNG to Displace Coal and Russian Gas*
- *Asia's Growing Opportunity for Coal-to-Gas Switching*
- *Actions Needed to Increase U.S. Natural Gas Production and Exports*
- *Reducing Methane and CO_2 from U.S. Natural Gas to Maximize Climate Benefits*

Taken together, today's recommendations and these upcoming briefs will compromise a comprehensive report on the topic.

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Paul Bledsoe is a strategic adviser for PPI, working on intersection of U.S. and global energy, climate, and economic policy. He is also a Professorial Lecturer at American University's Center for Environmental Policy. Paul served as communications director of the White House Climate Change Task Force under President Clinton, as special assistant to U.S. Interior Secretary Bruce Babbitt, and communications director of the U.S. Senate Committee on Finance under former Chairman Daniel Patrick Moynihan. He was formerly senior policy advisor to the Presidential Commission on the BP Oil Spill, director of strategy for the National Commission on Energy Policy, and a teaching fellow at Oxford University's School of Geography and the Environment. Paul has been a leading figure in shaping two major climate agreements — the Paris Climate Agreement of 2015 and the Kigali Agreement to phase out HFCs of 2016. He writes often on climate and energy in the New York Times, Washington Post, Financial Times, Politico, USA Today, LA Times, The Hill and other leading publications. Paul received a B.A. with honors and a M.A from Ohio State University.

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