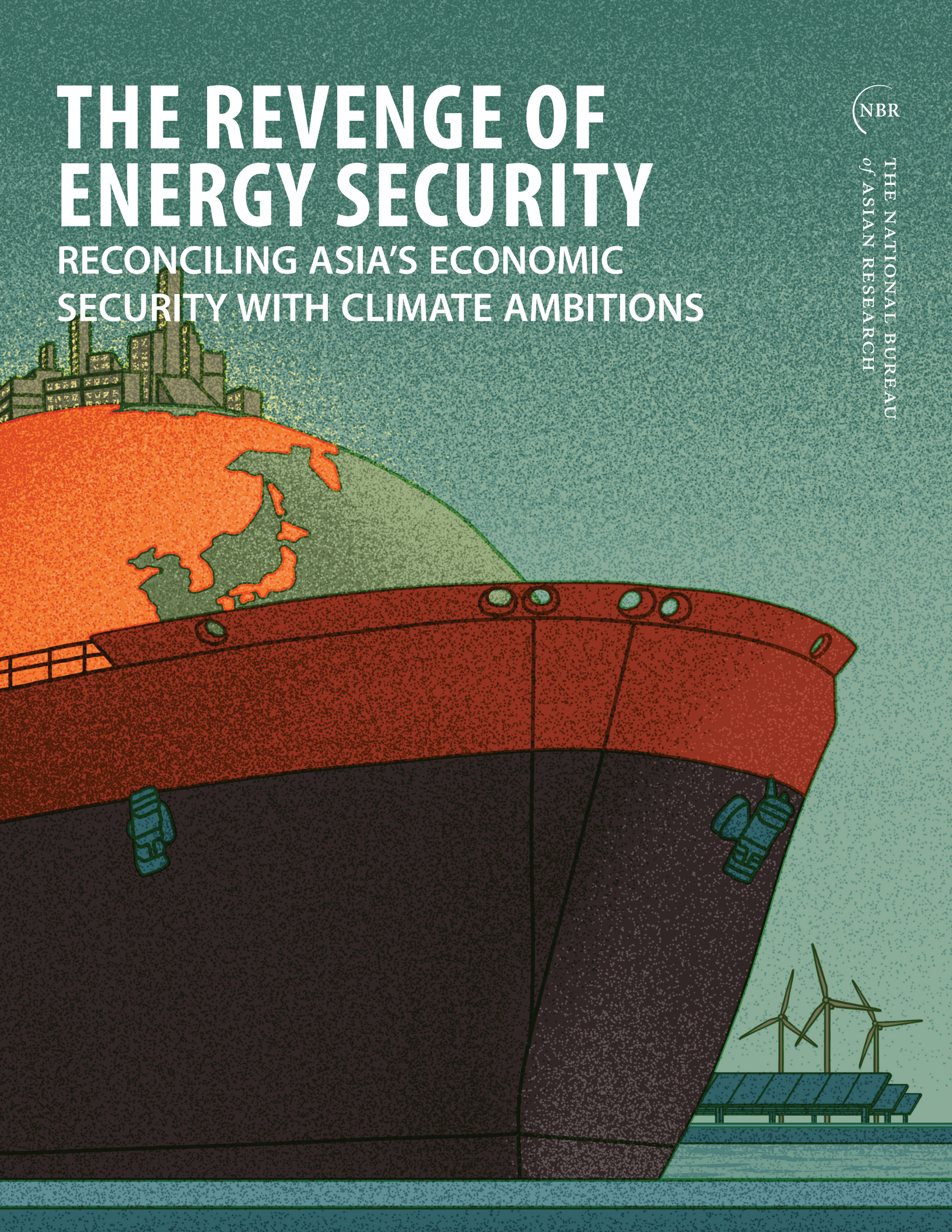
THE REVENGE OF ENERGY SECURITY

RECONCILING ASIA'S ECONOMIC SECURITY WITH CLIMATE AMBITIONS



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THE REVENGE OF ENERGY SECURITY

Reconciling Asia's Economic Security with Climate Ambitions

Erica Downs, Vandana Hari, Meredith Miller, Jennifer F. Sklarew, and Rahul Tongia

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Reconciling Asia's Economic Security with Climate Ambitions

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FOREWORD

Energy security has once again made its way to the top of the agenda across the Indo-Pacific region in the wake of geopolitical disruptions, rising strategic tensions, and the global pandemic. Anxieties began to intensify with the outbreak of the U.S.-China trade war in 2018. Escalating U.S.-China strategic competition and deteriorating relations triggered concerns across Asia that vital energy imports and transportation bottlenecks could be impacted in any potential confrontation between the two powers. The Covid-19 pandemic, which brought huge and costly disruptions to global energy demand and supply chains, further fanned concerns over the potential vulnerability of Asia's long-distance energy transportation supply lines from the Middle East and Africa. Finally, fuel prices in the Indo-Pacific spiked to historic highs in the wake of Russia's invasion of Ukraine and Europe's progressive loss of access to Russian pipeline natural gas in early 2022. Oil prices jumped to $130 in the wake of the invasion before settling back into the $80 range, liquefied natural gas (LNG) prices rose to unprecedented and punishing highs in Asia and Europe, and coal prices skyrocketed fourfold. Electricity shortages and the threat of blackouts haunted political leaders across Asia through the summer and winter of 2022–23.

These combined shocks brought an end to the period following the 2015 Paris Agreement, in which energy policy had focused increasingly on building a cleaner global energy system, addressing climate change, and achieving rapid decarbonization of energy use. Of course, energy security concerns never left the strategic agenda in the region, particularly in Japan, South Korea, China, and India, which are highly dependent on oil, LNG, and coal imports that must transit lengthy and potentially vulnerable maritime routes. But the historic importance of the Paris Agreement in a period of relatively moderate and stable oil, LNG, and coal prices allowed countries to shift their attention toward the climate challenge as the defining energy issue of the times.

The huge disruption in energy supplies, combined with enormous, unprecedented increases in fuel price across Asia, has produced an excruciating dilemma for policymakers. The imperatives of meeting the immediate energy security crisis in a heavily coal- and oil-dependent region such as Asia meant reinforcing the use of baseload fossil fuel supplies, particularly for power generation and transport, in order to manage the looming damage to economies of skyrocketing fuel prices and electricity shortages. Coal use surged across the region, and plans for new coal-fired power plants have jumped, especially in China, dealing a serious setback to global efforts to reduce coal use. Carbon emissions across the region have risen sharply as a result. LNG has been put in a particularly precarious position as unprecedented high prices risk undermining its claim to be developing Asia's "reliable" and "affordable" transition fuel and alternative to coal.

The choices that the Indo-Pacific region's major energy consumers make will reverberate globally because this coal- and carbon-intensive region is the key to achieving the goals of the Paris Agreement. But in the scramble to ensure adequate oil, LNG, and coal supplies at whatever environmental and financial cost, longer-term concerns about carbon emissions and climate change have been sidelined temporarily in the push to avoid blackouts and fuel shortages. There are serious concerns that the energy security emergency could profoundly slow momentum toward a cleaner and lower-carbon energy future in the Indo-Pacific.

Fortunately, the energy crisis has also served as a sharp reminder to governments and policymakers across the region of the economic and energy security benefits of accelerating the move toward a cleaner energy mix. This transition has been "securitized" inasmuch as it potentially represents the route to escaping the region's half-century-long energy security challenge driven by dependence on fossil fuel imports. Consequently, despite near-term pressures, governments across Asia continue to reaffirm their climate commitments, and many are in fact speeding up their plans and efforts to transition to clean energy.

In reality, each country in the region is charting its own path to reconciling near-term energy security challenges with longer-term climate commitments. Because developing Asia has become ground zero for future growth in global energy demand, the choices that these countries make will have profound implications not only for traditional fossil fuel markets but, more importantly, for the outlook for the global clean energy transition. Understanding what to expect in the major energy market countries, including China, Japan, India, and key developing Southeast Asian countries, is vital for assessing the prospects for progress on the global climate challenge.

To evaluate the implications of competing energy and economic security pressures and climate goals, the National Bureau of Asian Research (NBR) commissioned five essays by scholars with expertise on these issues and the Indo-Pacific region. The preliminary findings were discussed at a workshop in Washington, D.C., on July 19, 2023, which NBR was pleased to once again cohost with the Wilson Center. Participants included senior representatives from the U.S. government and foreign policymaking communities as well as leading industry and geopolitical experts. The authors have drawn on feedback they received at the workshop to strengthen their research and findings.

In the first essay, Vandana Hari, founder and CEO of the energy consulting firm Vanda Insights, examines the prospects for future growth in LNG demand in developing Asia in the wake of the enormous price shock of 2022. This question is crucial for the global LNG market and the LNG industry because developing Asia has been expected to be the largest driver of future LNG demand growth as countries shift toward natural gas as a substitute for coal over the next two decades. She suggests that the price shock and scramble for supplies has undermined how energy policymakers in the region view the future role of LNG and natural gas as transitional fuels in their energy mix. The price spike and outright loss of contracted supplies as numerous cargoes were diverted to higher-priced spot markets have contributed to a view that LNG is increasingly expensive and unreliable. This runs directly counter to suppliers' efforts over the past decade to convince new buyers in Thailand, the Philippines, Vietnam, India, and Bangladesh that LNG will be affordable and secure. Hari contends that LNG remains in plans for the energy mix across the region because rapid growth in energy demand will force policymakers to look at all available options. But with LNG prices that are still over $11, regional countries have focused on more cost-competitive renewables and even nuclear energy.

In the second essay, Erica Downs from the Center on Global Energy Policy at Columbia University's School of International and Public Affairs examines China's energy security strategy in the wake of the Russia-Ukraine war, the impact on Sino-Russian energy and strategic relations, and the implications for the United States. She argues that Russia's invasion of Ukraine has strengthened the country's incentives to accelerate the redirection of its energy trade from west to east. And it has given China an opportunity to deepen its energy ties with Russia and expand imports of Russian energy supplies at a lower cost. Russia was already the second-largest oil and natural gas supplier to China (both pipeline and LNG). China has sharply boosted its oil imports,

taking advantage of lower prices due to sanctions and the Western oil price cap. However, China has been more circumspect on the gas side. While Moscow desperately wants to expand its pipeline gas sales to China to replace its lost markets in Europe, Beijing has been ambiguous about committing to the Power of Siberia 2 pipeline project. The project would also raise the risk that China's national oil companies and banks would run afoul of U.S. sanctions. On balance, from the perspective of U.S. interests, China has managed its expanded energy ties with Russia while seeking to limit the potential damage to its relations with the United States. At the same time, China's desire to diversify its dependence on energy imports opens the opportunity for U.S. crude oil and LNG exporters to expand exports to China.

Japan's efforts to balance its energy security and resiliency imperatives with its attempts to accelerate its progress on clean energy are the subject of the third essay by Jennifer Sklarew from George Mason University. She discusses how the 2011 Fukushima nuclear disaster led to heavier reliance on LNG and coal for power generation to replace lost nuclear generation. But imperatives to support energy security weakened Japan's capacity to advance its decarbonization goals and meet its international commitments. Rising energy prices and supply uncertainty following Russia's invasion of Ukraine have similarly reinforced Japan's reliance on coal. At the same time, the LNG price shock has strengthened Japan's efforts to more aggressively diversify supply sources and seek a more flexible long-term contract mix through new projects in Canada, Mozambique, and the United States. The crisis also has increased public support for nuclear power, and the government has announced extensive new construction plans as well as restarts of viable existing nuclear plants. The 2022 Green Transformation (GX) strategy envisions the extensive use of carbon capture, utilization, and storage and hydrogen technology, along with the acceleration of both renewable and nuclear energy. The plan is seen as key to long-term efforts to decarbonize while also strengthening energy security and resilience.

In the fourth essay, Rahul Tongia from the Centre for Social and Economic Progress in New Delhi provides insight into India's energy security and decarbonization dilemmas in the wake of Russia's invasion of Ukraine. He describes current Indian energy policy as a twin strategy of aggressively going green while falling back on fossil fuels. India has become "even less apologetic for its strategic use of coal." Although coal is highly polluting, it is abundant domestically and accounts for three-quarters of the country's electricity generation. India continues to pursue an ambitious green energy plan featuring enormous increases in solar and wind capacity that would gradually displace coal. However, actual growth in renewables has fallen far off pace, and future targets appear extremely ambitious. India will continue to struggle with the challenge of scaling up alternatives to coal, particularly with adding the grid storage needed to manage limited grid capacity. However, the long horizon of 2070 for the full net-zero commitment does give a necessary cushion, despite short-term limits.

In the final essay, Meredith Miller of Albright Stonebridge Group, part of Dentons Global Advisors, assesses the challenges for Southeast Asia to sustain momentum on its clean energy transition, with a focus on the potential role of LNG. The diversity of the region makes generalizations difficult, but governments across Southeast Asia recognize that reducing emissions is imperative. However, rapid economic and energy demand growth, along with price sensitivity to the cost of energy, makes decisions to shift investment toward cleaner energy challenging. Moreover, key regional countries, including Indonesia, Malaysia, and Thailand, are in the midst of delicate political transitions and election cycles, which heightens their sensitivity to the short-

term trade-offs of clean energy transitions. This is particularly relevant to the outlook for LNG, as the recent price shock has reinforced perceptions that it is expensive and unreliable. Progress on renewables and other decarbonization pathways is constrained by capital availability, uncertain regulatory frameworks, and high costs. International private capital, national collaborations, and regional cooperation will be required to sustain and accelerate the clean energy transition in Southeast Asia.

This collection of essays, building on discussions during the July 2023 workshop, paints a mixed picture of the impact of the resurgence of energy and economic security in the wake of the geopolitical and pandemic shocks of the past several years. The most damaging impact has been a doubling-down on fossil fuels, most importantly coal. Coal use and emissions have risen sharply across the Indo-Pacific, especially in China, which is a serious setback in progress toward a cleaner energy mix. Likewise, prospects for LNG, which many hope will be a substitute "transition fuel" for coal in Asia, have been undermined by the competition with Europe for secure supplies.

But these developments have also demonstrated that progress toward cleaner energy sources and technologies has the potential to decisively reduce the region's heavy dependence on imported energy. The climate benefits of clean energy are now being reinforced by added economic and energy security benefits. Japan's new GX plan reflects the country's efforts to escape the long-term conundrum created by its dependence on energy imports. China has raised its renewable energy targets and continues to lead on electric vehicles and other clean energy technologies. India's progress on solar energy is behind schedule but gaining traction and speed. And in Southeast Asia, countries like Indonesia and Malaysia are joining in plans to close many existing coal-fired power plants with support from international agencies and private capital. Altogether, there remains hope that the Indo-Pacific region can sustain its progress toward a cleaner energy future, despite the setbacks from recent energy and economic security shocks.

The 2023 Energy Security Program would not have been possible without the support, guidance, and contributions by a number of organizations and individuals whose efforts are particularly worthy of recognition. We are grateful to Chevron, ConocoPhillips, Freeport-McMoRan, the Japan External Trade Organization, Mitsubishi Heavy Industries, and Monitor Deloitte for their sponsorship of NBR's energy programming. We would also like to thank the many experts who contributed their insights into the energy transition trajectories of China, Japan, India, and Southeast Asian countries, particularly those who attended the workshop.

Lastly, working tirelessly behind the scenes to develop the program and refine the policy discussions were NBR's Audrey Mossberger, Emily Sparkman, Gillian Zwicker, Thomas Lutken, Micah Sindelar, Chihiro Aita, Eliana Guterman, and Owen Barnert. We are also grateful to Michael Kugelman and his team at the Wilson Center for their support of the workshop. We hope that this report provides a holistic overview of today's regional energy dynamics and security challenges for the Indo-Pacific.

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Asia Rethinks Its Energy Mix after a Volatile Year in Gas Markets

Vandana Hari

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EXECUTIVE SUMMARY

This essay examines how extreme volatility in the global liquefied natural gas (LNG) markets has prompted major Asian economies to re-examine their plans to increase the share of natural gas in their national energy mixes, while keeping in view the need to balance net-zero emissions targets with energy security and affordability.

MAIN ARGUMENT

Asia's price-sensitive economies are looking at ways to mitigate the potential risk of Europe paying top dollar to continue importing increasing volumes of LNG from the global market to make up for the loss of pipeline-supplied gas from Russia. Though natural gas is widely regarded in Asia as an important transition fuel as countries strive to accelerate their decarbonization efforts in the coming decades, the region is becoming increasingly dependent on importing natural gas as LNG, leaving it vulnerable to instabilities and price fluctuations for the commodity in international markets. Though the volatility in the LNG market in 2022 manifested most acutely in spot prices, Asia's long-term supply (most of which is benchmarked to Brent crude prices) has also become costlier as oil prices remain elevated.

POLICY IMPLICATIONS

- Even as Asian countries have become more concerned about the volatility of natural gas markets, most alternative sources of energy are far from ideal to replace this clean fuel.
- The region's increased use of coal, although a cheap and readily available resource, sets it back on its decarbonization goals. Renewables can serve as domestically sourced, low- (or zero-) carbon options, but even with an aggressive capacity buildout, they are often limited by issues of intermittency and a lack of grid connectivity or available energy storage options.
- Not all countries have nuclear power capacity, and those planning to set it up face major political and financing hurdles, not to mention long project lead times.
- Unlike most European countries, which typically seek LNG imports from the U.S. for a short term, Asian importers offer the U.S. long-term demand security.
- The U.S. can help strengthen Asia's energy security through natural gas by building out its LNG capacity and committing to supplying long-term volumes without requiring buyers to take equity stakes in the liquefaction projects. Selling LNG without destination restrictions, as the U.S. does now, offers much-needed flexibility to buyers in Asia.
- If the U.S. can convince more European buyers to commit to long-term contracts, it would help Asia by ensuring that more liquefaction capacity comes into the market and that occurrences of spot market volatility and price spikes stemming from Europe's sudden bouts of buying are lowered.

In 2022, Russia slashed pipeline gas supplies to Europe, prompting the continent to import unprecedented volumes of liquefied natural gas (LNG) at record-high prices. As a result, economies across Asia have begun to re-examine the role of the fossil fuel in their energy strategies for the medium term. The energy crisis of 2022 was only the latest trigger for Asian importers to rethink their reliance on LNG. Even before Russia's invasion of Ukraine, there was already a groundswell of conviction among policymakers, especially those in the developing economies, on the importance of balancing the clean energy transition with supply security, accessibility, and affordability.

Natural gas output in Asia is on the decline, thanks to aging reservoirs and a lack of new discoveries for decades. To some extent, the situation was exacerbated by the exodus of Western companies from the region's upstream sector in recent years as they pivoted away from fossil fuels. So stark is the shift in the region's gas supply and demand balances that even countries that have been major gas exporters, such as Indonesia, Malaysia, Thailand, and Vietnam, have become LNG importers as domestic production declines while demand at home spirals up. All of this means that across Asia energy transition strategies hinging on increased use of natural gas have become increasingly reliant on imported LNG. Since 2022, the region has had to compete for supply with higher-income nations in the developed West. The realization that the global market for gas could remain highly volatile is starting to dawn on most countries, resulting in a rethinking of plans to expand the share of gas in their energy mixes based on imported LNG.

Some policy reconfiguration is already underway. This process varies from one country to another but broadly involves a pause or deceleration in the phase-out of coal-fired power and a greater emphasis on building out renewables and nuclear power capacity. In the case of Japan, a greater number of nuclear power plants that were mothballed after the March 2011 Fukushima accident are now being restarted. However, these alternative routes have their own costs and challenges, raising the prospect of gas coming back into favor in a few years, possibly aided by an expected 16% jump in global LNG capacity from 2025. The increasing likelihood of this scenario creates major uncertainty over the longer-term trajectory of Asian demand.

This essay examines the impact of the 2022 turmoil in the global LNG market on importers in Asia. It notes how governments across the region—in developed as well as emerging economies—have begun to whittle down the role of natural gas in their energy roadmaps, wary of jeopardizing supply security with an increased dependence on LNG imports. But there are no easy alternatives to gas, which is an ideal bridging fuel for transitioning to cleaner forms of energy. The United States, as a major and fast-growing LNG supplier, could look at ways to address the concerns of Asia's importers around supply security.

Jangled Nerves despite Cooling Gas Markets

The worst volatility in spot gas prices—stirred by Russia's invasion of Ukraine, the West's subsequent sanctions against Moscow, and the tit-for-tat weaponization of energy—appears to be over. The impact on the world's gas markets, however, could persist for the foreseeable future. Europe has indefinitely lost considerable supplies of low-cost Russian pipeline gas, and the world's LNG trade has been rewired around the new needs of the continent. As the supply of Russian pipeline gas to Europe slumped from an average of around 425 million cubic meters per day in 2021 to 234 million in 2022, the continent's net LNG imports jumped by 60% to 119.71 million

metric tons (mt).[1] The incremental volumes were mainly spot and short-term purchases. These supplies fetched higher prices in Europe and were therefore taken away from the Asian markets.

Asian LNG imports dropped 7.6% year-on-year to around 251.9 million mt in 2022, the first decline since 2015, and in contrast to a 7.0% annual rise in 2021.[2] A surge in spot LNG prices to record highs curbed demand in Asia, though the slowdown in China's activity amid Beijing's strict zero-Covid policy also contributed to a plunge in Chinese imports. Spot LNG prices in Asia averaged around $34 per million British thermal units (MMBtu) in 2022, nearly twice the annual average of 2021.[3] Asia was still the largest LNG-importing region, but its share of the global total slipped to 65% from 73% in 2021.[4]

Meanwhile, as energy demand across Asia continued to rebound as expected with the post-pandemic reopening, many countries switched to burning more coal. Demand in China, which accounts for around half of the world's coal consumption, rose 4.6% from a year earlier to a record 4.52 billion mt in 2022, while India's use jumped 8% to 1.16 billion mt.[5] Countries also resorted to energy rationing and power cuts, among other contingencies. Governments that were already battling high inflation capped gas and power prices by either taking on the subsidy burden or passing it on to domestic utilities, even at the risk of pushing them deep into the red.

Since the start of 2023, tightness in the global gas market has eased considerably, thanks to a milder winter and a concerted effort in Europe to curtail consumption of the fuel in both the industrial and household sectors. Natural gas consumption in the advanced economies of Europe fell by about 55 billion cubic meters year-on-year during the 2022–23 heating season, its steepest drop in absolute terms for any winter on record, according to the International Energy Agency.[6] Gas consumption in Europe for 2022 collapsed by around 13% year-on-year to 427 billion cubic meters. Thanks to a mild 2022–23 winter, Europe emerged from the high-demand season with comfortable levels of gas in storage. Asia's benchmark spot LNG prices, the Platts JKM (Japan Korea Marker), tumbled from highs of around $71 per MMBtu in August, when jitters over winter supply were peaking, to around $10–$12 per MMBtu over the first half of 2023 (see **Figure 1**).

However, with prices still at the top end of the range seen in the five years prior to the Russia-Ukraine war, Asian buyers have been slow to re-enter the spot market. The three big markets—China, Japan, and South Korea—together imported 99.06 million mt of LNG in the first half of 2023, according to data compiled by the Japan Organization for Metals and Energy Security, down 2% from a year earlier.[7] Though European gas demand continued to decline during that period—by around 11%, or nearly 27 billion cubic meters compared with a year earlier—the region's LNG

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1 Oxford Institute for Energy Studies, "Gas Markets in 2023: Tracking Key Metrics," Quarterly Gas Review, July 2023, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2023/07/OIES-Quarterly-Gas-Review-Issue-22.pdf; and International Group of Liquefied Natural Gas Importers (GIIGNL), "The LNG Industry: GIIGNL Annual Report," 2023, https://giignl.org/wp-content/uploads/2023/07/GIIGNL-2023-Annual-Report-July20.pdf.

2 GIIGNL, "The LNG Industry: GIIGNL Annual Report."

3 Sam Reynolds, "Asia's Lower LNG Demand in 2022 Highlights Challenges for Industry Growth," Institute for Energy Economics and Financial Analysis, January 11, 2023, https://ieefa.org/resources/asias-lower-lng-demand-2022-highlights-challenges-industry-growth.

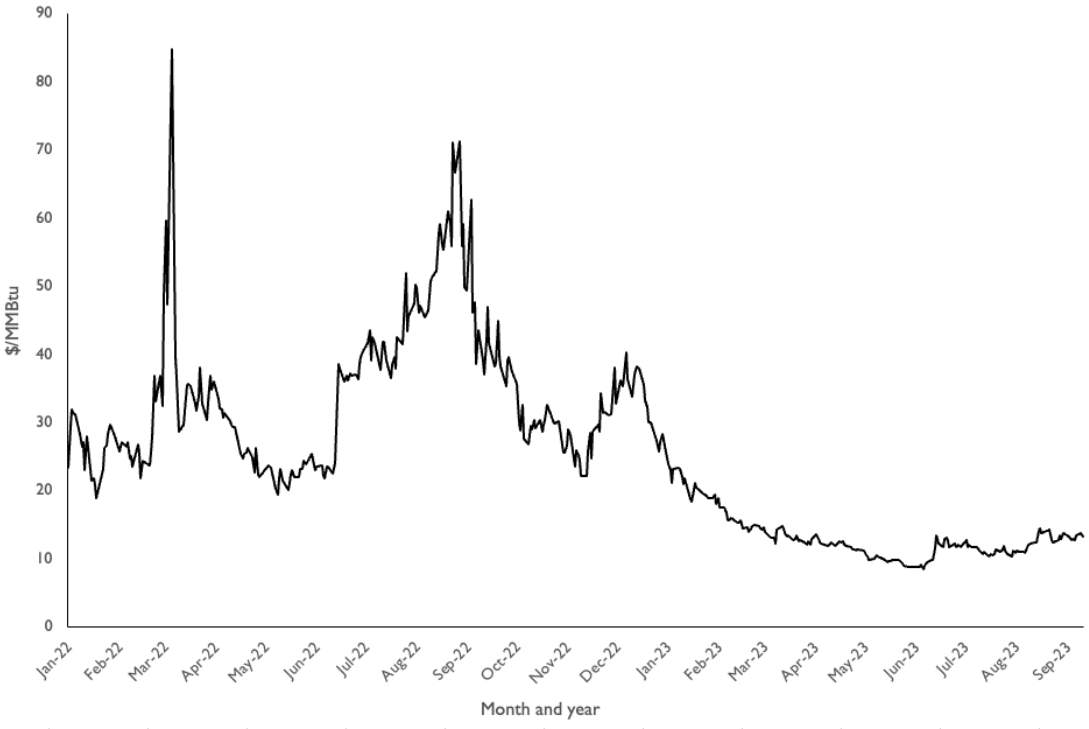
4 GIIGNL, "The LNG Industry: GIIGNL Annual Report."

5 International Energy Agency, "Coal Market Update," July 2023, https://www.iea.org/reports/coal-market-update-july-2023.

6 Peter Zeniewski, Gergely Molnar, and Paul Hugues, "Europe's Energy Crisis: What Factors Drove the Record Fall in Natural Gas Demand in 2022?" International Energy Agency, March 14, 2023, https://www.iea.org/commentaries/europe-s-energy-crisis-what-factors-drove-the-record-fall-in-natural-gas-demand-in-2022.

7 Japan Organization for Metals and Energy Security, "Trend of Natural Gas and LNG Prices," July 2023, https://oilgas-info.jogmec.go.jp/nglng_en/1007907/1009847.html.

FIGURE 1 Japan Korea Marker



SOURCE: Platts, 2023.

imports reportedly rose nearly 7% to 65.25 million mt, according to Cedigaz.[8] Meanwhile, the supply of Russian pipeline gas to Europe dwindled to an average of around 62 million cubic meters per day in the second quarter of 2023.[9] Europe has managed to stock up on gas for the 2023–24 winter well ahead of time, but the prospect that a colder winter could spur a spike in its LNG buying and spot prices once again hangs like a dark cloud over Asian buyers.

Asia Rethinks LNG Affordability and Supply Security

Spot Market Dislocations Filter Down to Term LNG Contracts

Asian governments' medium- and long-term plans for the use of natural gas are influenced by developments in the spot LNG market as well as by trends in the pricing formulas of existing and new long-term contracts, a majority of which are linked to Brent crude prices. Around the globe, spot and short-term imports accounted for roughly 35% of the global LNG trade in 2022, according to the International Group of Liquefied Natural Gas Importers, and long-term supplies accounted for the rest.[10] While prices of LNG imported under long-term contracts did not surge as much as spot cargo prices last year, they were also affected by the energy crisis. The cost of long-

8 "Cedigaz: European LNG Demand Boosted Global Imports in H1," Tank Terminals, September 6, 2023, https://tankterminals.com/news/cedigaz-european-lng-demand-boosted-global-imports-in-h1.

9 Oxford Institute for Energy Studies, "Gas Markets in 2023."

10 GIIGNL, "The LNG Industry: GIIGNL Annual Report."

term LNG supplies rose in line with higher crude prices as Russian oil exports were disrupted by Western sanctions. Global oil and gas prices are interlinked to an extent, as costlier gas encourages some switching to products like diesel and fuel oil. Brent crude averaged about $99 per barrel in 2022, up nearly 40% from a year earlier.[11]

Importers such as India's GAIL were affected in other ways as well. SEFE Marketing & Trading, the Singapore unit of Russia's Gazprom, reneged on some of its term LNG shipments to GAIL by paying 20% of the contractual value of the shipments as a breakup fee.[12] For Gazprom, the decision was attractive because the penalty was only 4% of the value of prevailing gas prices in Europe. GAIL, however, had to pay much more to secure replacement cargoes from the spot market than the compensation it received. GAIL has since initiated legal proceedings against Gazprom over the issue, while buyers entering new term contracts for LNG are said to be seeking better protections against such cancellations.

What further complicates future planning for Asia is the massive uncertainty over how European countries that are accelerating their phase-out of fossil fuels will manage their energy needs in the coming years, and what place gas and LNG will find in Europe's energy mix. Whether Europe will continue buying LNG from Russia in the coming years or pivot to other suppliers, for how long and to what extent the continent would raise its LNG imports, and whether it would continue buying incremental volumes from the spot market or sign long-term contracts have emerged as key questions with no clear answers. The route taken will have a major influence on overall global LNG supply-demand balance in the coming years, the ratio of spot and term supply availabilities, and the evolution of prices. The uncertainties have made medium- to long-term import planning difficult for Asian buyers.

Historically, European buyers have secured a low proportion of their LNG needs under long-term contracts. Although Europe's increased dependency on LNG imports in the wake of the Russia-Ukraine war is widely regarded as a structural shift, countries in the region have been generally reluctant to sign long-term contracts, as these are seen as being in conflict with their aggressive decarbonization goals.

Nonetheless, Europe has been ramping up its LNG import and regasification capacities since last year. The region had 280 billion cubic meters per year (about 206 million mt per year) of LNG import capacity at the end of 2022, up 6.5% from 2021, according to the Institute for Energy Economics and Financial Analysis.[13] Europe plans to boost its import capacity to 415 billion cubic meters per year by 2030, which would be more than double the region's LNG demand at that point in time, leading to massive unused capacity. Some analysts argue that with Russian pipeline gas supply out of the picture for the foreseeable future, European importers will simply need to sign up for more long-term LNG contracts. But opposition from the political and environmental lobbies will be hard to overcome.

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[11] This figure was calculated from the settlement prices for ICE Brent futures, which Vanda Insights tracks daily.

[12] Debjit Chakraborty and Stephen Stapczynski, "Ex-Gazprom Unit Pays Tiny Penalty to Cancel LNG Cargoes to India," Bloomberg, September 12, 2022, https://www.bloomberg.com/news/articles/2022-09-12/ex-gazprom-unit-pays-tiny-penalty-to-cancel-lng-cargoes-to-india?sref=cOIE6ab1.

[13] Charlie Cooper, "Europe Heading for Huge Excess LNG Import Capacity, Experts Warn," *Politico*, March 21, 2023, https://www.politico.eu/article/europe-huge-excess-lng-liquefied-natural-gas-import-capacity-expert-warn.

More Term Deals Are Not an Easy Option

One way for Asian importers to partially mitigate the impact of frequent spikes in European LNG imports and spot market disruptions is to lock in more term supplies. Some Asian buyers have been scouting for and signing more short- and long-term LNG contracts since 2022, but the implied pricing has also surged in the aftermath of the energy crisis. China has managed to negotiate better pricing deals by locking in contracts with 20- to 27-year terms and having its companies take equity stakes in new liquefaction projects, but not all Asian buyers are able to do the same.

Term contracts in which the LNG price is set as a proportion of the prevailing price of crude are not too palatable if one takes the view that higher crude prices could persist for at least the next few years due to the ongoing Russia-Ukraine war and potentially over the longer term, as a slump in upstream investment tightens global oil supply. At the current Brent crude price of $90 per barrel, LNG supplied to Asia under existing long-term contracts would be priced around $12.00–$12.90 per MMBtu before regasification costs at the importer's end, according to information from Asian LNG importers. While such prices may sustain baseload purchases, given that long-term contracts come with take-or-pay clauses, they do not support the growing demand of existing Asian importers and certainly not that of the relatively new importers such as Thailand, Vietnam, Indonesia, and Malaysia.

U.S. term LNG contracts are typically linked to Henry Hub gas prices, which may remain relatively shielded from volatility in the European or Asian markets. But the recent deals signed on a Henry Hub linkage, after accounting for the higher freight costs from the United States to Asia, yield LNG prices similar to those of the crude price–linked term agreements. Moreover, despite the United States' recent spate of new liquefaction-capacity additions and projects in the pipeline, there is plenty of competition from global buyers, including portfolio players. The latter, also known as aggregators, are companies that buy LNG from a wide range of suppliers around the globe and resell it to various customers.

Asia Turns Wary of Increased Gas Use

Demand in Japan and South Korea, Asia's oldest LNG markets, is projected to decline in the coming years. Japan aims to reduce the share of LNG in its electricity mix from 38% in 2022 to 20% by 2030 by offsetting LNG with additional shares of nuclear and renewable energy.[14] Over the longer term, economic forecasts and demographic shifts in the country anticipate a continued drop in energy use. Earlier this year, South Korea set a target of boosting nuclear power generation at the expense of gas-fired electricity. The government plans to raise the share of nuclear power generation from 27.4% in 2021 to 32.4% in 2030 and 34.6% by 2036. Over the same period, it aims to cut the share of LNG from 29.2% in 2021 to 22.9% in 2030 and to a mere 9.3% in 2036.[15] The reduction is motivated by a desire to reduce the country's spending on LNG imports and meet emissions targets. However, the phase-out of coal power plants in South Korea is expected to sustain growth in demand for gas as a replacement fuel for electricity generation. For both Japan

[14] "LNG Remains Key Despite Japan's Aim to Reduce Natural Gas Demand," BMI, February 15, 2023, available at https://www.fitchsolutions.com/oil-gas/lng-remains-key-despite-japans-aim-reduce-natural-gas-demand-16-02-2023.

[15] "South Korea Targets 34.6% Nuclear and 30.6% Renewable Power Generation in 2036," Enerdata, January 13, 2023, https://www.enerdata.net/publications/daily-energy-news/south-korea-targets-346-nuclear-and-306-renewable-power-generation-2036.html.

and South Korea, falling short of alternative energy targets for nuclear and renewable energy would likely mean that gas and LNG imports must pick up the slack.

China, which became an LNG importer in 2006 and overtook Japan as the world's largest importer in 2021, is leaning heavily on coal as it prioritizes short-term energy security. Domestic gas production and pipeline gas imports from Russia are seen as important for the diversification of China's energy sources and are expected to rise. Though the country's LNG demand is forecast to grow at a modest pace in the coming years, it could peak by 2030. Gas accounted for 9% of China's energy mix in 2022. Projections for the rate of growth in gas demand in the coming years vary widely. The Economics and Technology Research Institute, a well-regarded think tank of the state-owned China National Petroleum Corporation, forecasts that the share of gas will rise to 12% by 2030, which would be below the government's current target of 15%.[16]

Prospects for demand growth in the Philippines and Vietnam, which debuted as LNG importers in 2023, also appear limited. The countries are struggling to pass on the high cost of imported LNG (compared with domestically produced gas) into retail power prices. Despite both countries having plans to boost their LNG import and regasification capacity, neither has signed a long-term contract so far. Thailand has become wary of increasing its dependence on LNG imports to offset a decline in domestic gas production and has intensified its search for alternatives, ranging from coal to renewables. It is also doubling down on increasing domestic gas production. The Thai government delayed the decommissioning of coal-fired power plants and bought more electricity from local renewable power plants last year, stating that it would even prefer to burn oil for electricity generation if it were cheaper than LNG.[17]

India is officially maintaining a target of 15% share for natural gas in its primary energy mix by 2030, up from the current 6%, but market players regard this goal as unrealistic. LNG is increasingly viewed in the country as expensive and unreliable,[18] with most demand coming from the industrial and fertilizer sectors in India (the latter being subsidized by the government). India's power sector cannot afford gas unless it is priced well below $10 per MMBtu. Renewables and coal offer much more competitive pricing. Moreover, domestic gas production is expected to satisfy some of the demand in the coming years. Hopes are pinned on Reliance and BP's MJ field in the deepwater KG-D6 block, which began gas production in June 2023.[19] Indian buyers are looking to sign more term LNG contracts for security of supply but are struggling to find sellers at their desired price level.

Bangladesh paid dearly in 2022 for ratcheting up its reliance on imported LNG to 22% of its gas demand merely four years after debuting as an importer.[20] It suffered nationwide blackouts and economic damage after being forced to suspend spot imports amid the price spike in 2022. Despite this experience, the country plans to add three more LNG terminals to its current two and has gas-based power plants in planning and under construction.

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16 Ivy Yin and Eric Yep, "Unpacking CNPC's Net-Zero Road Map for China," S&P Global, February 8, 2022, https://www.spglobal.com/commodityinsights/en/market-insights/blogs/energy-transition/020822-china-net-zero-road-map-cnpc.

17 Emily Chow and Isabel Kua, "Thailand to Rely on Coal for Power Longer amid Record Gas Prices," Reuters, October 26, 2022, https://www.reuters.com/article/asia-energy-thailand-electricity/thailand-to-rely-on-coal-for-power-longer-amid-record-gas-prices-idUSL4N31R0VZ.

18 Saurav Anand, "India Aims to Triple Natural Gas Share to 15% by 2030: Minister," *Mint*, August 10, 2023, https://www.livemint.com/industry/energy/india-aims-to-triple-natural-gas-share-to-15-by-2030-minister-11691672818065.html.

19 "Reliance and BP Commence Production from Third Deepwater Field in India's KG D6 Block," BP, Press Release, June 30, 2023, https://www.bp.com/en/global/corporate/news-and-insights/press-releases/reliance-and-bp-commence-production-from-third-deepwater-field-in-indias-kg-d6-block.html.

20 "Bangladesh's Reliance on LNG Increases Heat Stress, Finance and Energy Risks," Zero Carbon Analytics, May 2023, https://zerocarbon-analytics.org/archives/energy/bangladeshs-reliance-on-lng-increases-financial-energy-and-climate-risks.

Pakistan, which was left out of the spot LNG market for more than a year as suppliers shunned its purchase tenders amid the country's sovereign credit crisis, decided earlier in 2023 not to build any new power plants dependent on imported LNG, focusing instead on using more domestic coal. It has struggled to sign new term LNG import deals and no longer regards LNG imports as part of its long-term energy plan.

The Gas Exporting Countries Forum in March 2023 projected that natural gas demand in the Asia-Pacific will jump 78% by midcentury—from 910 billion cubic meters in 2021 to 1,620 billion by 2050.[21] The share of gas in the regional energy mix will climb from 12% in 2021 to over 16% by 2050, led by electrification, policy measures encouraging a switch from oil and coal to gas, and investments in gas infrastructure, including new regasification capacity and the expansion of transmission and distribution networks. Such demand forecasts now face a major downside risk or, at the very least, are vulnerable to deviations from a straight-line growth trajectory.

Conclusion

Natural gas has long been viewed as an important transition fuel in Asia. With the region's energy demand far outpacing its production of natural gas, countries had pinned their hopes on global LNG supplies. But policymakers in the region are increasingly also committed to balancing their national targets for reducing emissions with energy supply security and affordability. After the shock to gas markets in the wake of Russia's invasion of Ukraine, coming close on the heels of the energy crisis of late 2021 as economies began to recover from the pandemic, LNG importers across Asia, big and small, old and new alike, have returned to the drawing board to try and scale down the role of natural gas in their energy roadmaps. But there are no clear and readily available alternatives that can compete with natural gas on the metrics of abundant availability, price competitiveness, and relatively low carbon emissions (compared with coal).

Asia needs access to affordable and reliable flows of LNG in the coming years, as natural gas would be the best fuel choice, especially for baseload power generation. This could enable countries to phase out coal use and get back on track with their net-zero emissions targets. The solution may lie in major LNG producers such as the United States taking the chance on Asia to build out enough capacity to serve the region's needs at an affordable price in the decades to come. In that regard, Washington would do well to ensure that the Federal Energy Regulatory Commission and Department of Energy approvals for new liquefaction projects are expedited. Increased LNG production capacity globally, preferably with some spare capacity available as a buffer to absorb the shock of major unanticipated outages, would help minimize energy crises and provide the gas supply stability, security, and affordability that could help Asia manage a smoother energy transition.

[21] Alexander Ermakov, "The Future of Natural Gas in Asia Pacific: Large Potential for Demand Growth," Gas Exporting Countries Forum, March 2023, https://www.gecf.org/events/expert-commentary-the-future-of-natural-gas-in-asia-pacific.

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China-Russia Energy Relations in the Wake of the War in Ukraine

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EXECUTIVE SUMMARY

This essay examines the China-Russia energy relationship since Russia invaded Ukraine in February 2022 and assesses the implications for the U.S.

MAIN ARGUMENT

China has approached Russia's efforts to reorient its energy trade from Europe to Asia in response to Western sanctions with a mix of opportunism and caution. Chinese companies have taken advantage of discounted prices to increase their purchases of Russian energy. They are also expanding the use of China's currency for trade settlement and supplying equipment to Russia's Arctic LNG (liquefied natural gas) 2 project. However, Chinese entities have been careful not to run afoul of U.S. sanctions and have avoided undertaking any major new energy projects, notably the proposed Power of Siberia 2 natural gas pipeline.

POLICY IMPLICATIONS

- China's relationships with the U.S. and Europe likely will influence the trajectory of China-Russia energy relations.
- China's purchase of Russian seaborne crude oil above the $60 per barrel price cap imposed by the G-7, the European Union, and Australia supports the price cap coalition countries' goal of maintaining the supply of Russian crude on the world market but does not fully support their goal of minimizing Russia's oil export revenue.
- China is likely to purchase more LNG from the U.S.; exposure to U.S. natural gas prices and the lack of destination restrictions on U.S. LNG exports appeal to Chinese buyers.
- The renminbi is unlikely to replace the dollar as the primary currency for energy trade settlement anytime soon.

Russia's invasion of Ukraine and the resulting Western sanctions have provided Russia with an incentive to accelerate the reorientation of its energy trade from Europe to Asia. Europe was Russia's most significant energy importer on the eve of the war. In 2021, Russia exported 49% of its crude oil and condensate, 74% of its natural gas, and 31% of its coal to Organisation for Economic Co-operation and Development (OECD) countries in Europe.[1] However, several factors—namely, the voluntary shunning of Russian energy in the immediate wake of the invasion; the European Union's subsequent bans of Russian crude oil, coal, and refined oil products; and the imposition of a $60 per barrel price cap on seaborne Russian crude oil exports—prompted Russia to redirect more of its energy exports to Asia, often selling at a discount.

China, Russia's most important energy trade partner in Asia before the start of the war, has responded to Russia's efforts to expand bilateral energy ties with a mixture of opportunism and caution. Chinese buyers have capitalized on the discounted prices to increase their purchases of Russian energy, especially crude oil and coal. They are also expanding the use of China's currency for energy trade settlement and supplying equipment to Russia's Arctic LNG (liquefied natural gas) 2 project. But Chinese entities have been careful not to run afoul of Western sanctions and have avoided undertaking any major new energy projects, notably the proposed Power of Siberia 2 natural gas pipeline, a project that is especially important to President Vladimir Putin because it would help Russia make up for a portion of the export market it has lost in Europe since the war began.

This essay is divided into three sections. The first describes China-Russia energy relations on the eve of the war, and the second explains how the bilateral energy relationship has evolved since Russia's invasion of Ukraine. Section three then discusses implications for the United States.

China-Russia Energy Relations on the Eve of the War in Ukraine

China and Russia had a robust energy trade relationship before Russia's invasion of Ukraine. Russia was already a top energy supplier to China in 2021, valued in Beijing not only for the large volumes of energy it exports to China but also because of the diversity of channels through which Russian energy flows. The prewar period also saw China's emergence as a catalyst for the development of LNG projects in Russia's High North, which support Moscow's two goals of diversifying natural gas exports through LNG and reaching a 20% share of the global LNG market by 2035.[2]

Trade

In 2021, Russia was China's second-largest supplier of crude oil after Saudi Arabia. China imported 1.6 million barrels per day (bpd) from Russia, accounting for 15% of China's imports.[3] Russian crude exports to China were roughly evenly divided between seaborne deliveries and

[1] U.S. Energy Information Administration, "Europe Is a Key Destination for Russia's Energy Exports," December 20, 2022, https://www.eia.gov/todayinenergy/detail.php?id=55021.

[2] "Russia's LNG Plans Face Rethink after EU Sanctions on Equipment—Analysts," Reuters, April 12, 2022, https://www.reuters.com/business/energy/russias-lng-plans-face-rethink-after-eu-sanctions-equipment-analysts-2022-04-12.

[3] General Administration of Customs of the People's Republic of China (PRC), "Customs Statistics," http://stats.customs.gov.cn/indexEn.

pipeline deliveries. Crude oil was shipped to China through both a spur from Russia's Eastern Siberia–Pacific Ocean (ESPO) pipeline and the Kazakhstan-China oil pipeline.[4]

Russia was likewise China's second-largest supplier of coal behind Indonesia in 2021. It shipped 57 million tons of coal to China, accounting for 18% of China's imports.[5] Russia had begun to expand its railroads to increase coal deliveries to China.[6]

Russia was China's third-largest supplier of natural gas after Australia and Turkmenistan in 2021, accounting for 10% of China's imports.[7] It is the only country to deliver natural gas to China via both tanker and pipeline. In 2021, Russia's LNG exports to China (4.5 million tons or 6.2 billion cubic meters [bcm]) were 60% of its shipments through the Power of Siberia 1 pipeline (7.5 million tons or 10.4 bcm), which is ramping up to its full capacity of 38 bcm.[8]

The two countries laid the groundwork for more pipeline gas deliveries on the eve of the war. When Putin visited Beijing in early February 2022, China National Petroleum Corporation (CNPC) and Gazprom, Russia's state-owned pipeline monopoly, signed an agreement for Russia to supply China with 10 bcm per year for 25 years through the Far Eastern Route, a spur from Russia's Sakhalin-Khabarovsk-Vladivostok pipeline to northeast China.[9]

Russia's importance to China as an energy supplier is not only because of its status as one of China's largest suppliers but also because it is arguably the country that has done the most to help China diversify its oil and natural gas imports away from world oil transit chokepoints, such as the Strait of Hormuz and the Strait of Malacca.[10] Russia is responsible for virtually all of China's overland oil deliveries. Of the roughly 900,000 bpd of oil delivered by Kazakhstan and Russia via pipelines in 2022, nearly 90% was Russian crude.[11] Once both Power of Siberia 1 and the Far Eastern Route are operating at capacity (a combined 48 bcm), Russia may rival or surpass Turkmenistan as China's top source of pipeline gas imports.

Investment

Arguably the most consequential energy investments that Chinese entities have made in Russia are those that catalyzed the development of Russian LNG export projects above the Arctic Circle. They played a key role in helping Novatek, Russia's largest independent gas producer, deliver Yamal LNG on time and on budget, despite U.S. and European sanctions.[12] After Western banks shied away from the Arctic project following Russia's annexation of Crimea, Chinese banks rescued it,

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4 "Russia Faces Export Challenges in Europe, Asia," *Petroleum Intelligence Weekly*, January 20, 2022, https://www.energyintel.com/0000017e-72ac-d6d7-afff-76adda410000.

5 General Administration of Customs (PRC), "China Import: Coal & Lignite," https://www.ceicdata.com/en; and "Energy Production in December of 2021," National Bureau of Statistics (PRC), Press Release, January 18, 2022, http://www.stats.gov.cn/english/PressRelease/202201/t20220118_1826644.html.

6 Yuliya Fedorinova and Aine Quinn, "Putin Is Betting Coal Still Has a Future," Bloomberg, May 30, 2021, https://www.bloomberg.com/news/articles/2021-05-30/russia-to-modernize-railroads-for-coal-exports.

7 General Administration of Customs (PRC), "Customs Statistics."

8 Ibid.

9 "Gazprom Starts Designing Pipeline to China from Russian Far East," Interfax, August 31, 2022, https://interfax.com/newsroom/top-stories/82721; and "Russia, China Sign Intergovernmental Gas Deal," Energy Intelligence, February 9, 2023, https://www.energyintel.com/00000186-35ce-da30-a7ff-bdff68580000.

10 U.S. Energy Information Administration, "The Strait of Hormuz Is the World's Most Important Oil Transit Chokepoint," December 27, 2019, https://www.eia.gov/todayinenergy/detail.php?id=42338; and U.S. Energy Information Administration, "World Oil Transit Chokepoints," July 25, 2019, https://www.eia.gov/international/analysis/special-topics/World_Oil_Transit_Chokepoints.

11 General Administration of Customs (PRC), "Customs Statistics."

12 Henry Foy, "Russia's Yamal Gas Project Navigates Ice and Sanctions," *Financial Times*, October 20, 2017, https://www.ft.com/content/8412ba8c-6ace-11e7-b9c7-15af748b60d0.

providing $12 billion in loans.[13] CNPC has a 20% stake in Yamal LNG, and China's Silk Road Fund holds 9.9%.[14] CNPC is also an offtaker.[15] Most of the project's contractors came from China.[16]

Before the start of the war, Chinese entities had begun to play a similar, albeit smaller, role in Novatek's Arctic LNG 2 project. Chinese banks committed loans of 2.5 billion euros to the project.[17] China National Offshore Oil Corporation Limited and CNPC each hold a 10% stake in the project, which is also using Chinese contractors.[18] In January 2022, Novatek signed supply agreements with two Chinese firms, ENN Energy and Zhejiang Energy.[19]

China-Russia Energy Relations Since the Start of the War in Ukraine

China has approached its energy relationship with Russia since February 24, 2022, with both opportunism and caution. Chinese importers have taken advantage of the discounts offered on Russian energy to expand their purchasing. They are also capitalizing on Western sanctions to push for greater use of China's currency in energy trade settlement and supplying equipment to Arctic LNG 2. However, Chinese entities have been careful to avoid undertaking activities that might run afoul of Western sanctions. In addition, China has not yet agreed to move forward with a bilateral energy project that Putin is especially eager to see developed: the Power of Siberia 2 natural gas pipeline.

Increased Purchases of Russian Energy

In 2022, China increased its imports of crude oil, coal, LNG, and pipeline gas from Russia (see **Figure 1**). Discounts on volumes shunned by other buyers spurred Chinese firms to increase their purchases of Russian energy. Meanwhile, China imported more gas through the Power of Siberia 1 pipeline as planned before the war, and it continued to buy increasing volumes of Russian energy in the first half of 2023. These elevated purchases increased the revenue that Russia earned from energy deliveries to China.

Crude oil. In 2022, China's imports from Russia grew by 8.3% to 1.7 million bpd. The increased purchases expanded Russia's share of China's crude oil imports from 15% to 17%, slightly below that of China's largest oil supplier, Saudi Arabia. In January–June 2023, China's crude oil imports from Russia grew by 21.5% over the same period in 2022, increasing Russia's share of China's crude oil imports to 18.6%.[20]

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13 "Yamal LNG Signed Loan Agreements with the Export-Import Bank of China and the China Development Bank," Novatek, Press Release, April 29, 2016, https://www.novatek.ru/common/upload/doc/2016_04_29_press_release_Chinese_banks_FA_(ENG).pdf.

14 "Yamal LNG: The Gas That Came In from the Cold," Total Energies.

15 "Binding Contract on LNG Supply Concluded with CNPC," Yamal LNG, Press Release, May 20, 2014, http://yamallng.ru/en/press/news/283.

16 Vita Spivak and Alexander Gabuev, "The Ice Age: Russia and China's Energy Cooperation in the Arctic," Carnegie Endowment for International Peace, December 31, 2021, https://carnegiemoscow.org/commentary/86100.

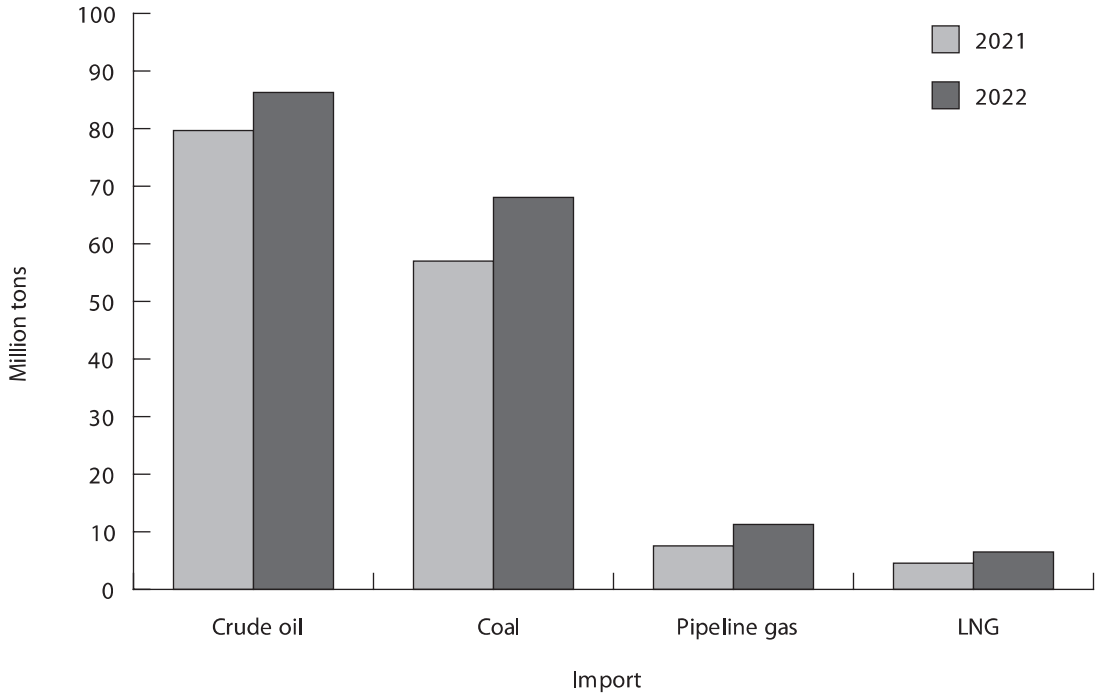
17 "Arctic LNG 2 Signs Loan Agreements with International Banks," Novatek, Press Release, November 30, 2021, https://www.novatek.ru/common/upload/doc/ALNG2_International_banks_Eng.pdf.

18 "Russia's Putin Approves Departure of Arctic LNG 2's First Line to Production Site," Reuters, July 20, 2023, https://www.reuters.com/business/energy/russias-putin-approves-departure-arctic-lng-2s-first-line-production-site-2023-07-20. On contractors, see, for example, Laura Zhou, "Chinese Firms 'Told to Stop Work on Russia Arctic LNG 2 Project' Due to EU Sanctions," *South China Morning Post*, May 20, 2022, https://www.scmp.com/news/china/diplomacy/article/3178572/chinese-firms-told-stop-work-russian-arctic-lng-2-project-due.

19 "Novatek and ENN Natural Gas Sign Sales and Purchase Agreement on Long-Term LNG Supply," Novatek, Press Release, January 11, 2022, https://www.novatek.ru/en/press/releases/index.php?id_4=4826; and "Novatek and Zhejiang Energy Sign Sales and Purchase Agreement on Long-Term LNG Supply," Novatek, Press Release, January 11, 2022, https://www.novatek.ru/en/press/releases/index.php?id_4=4825.

20 General Administration of Customs (PRC), "Customs Statistics."

FIGURE 1 China's energy imports from Russia in 2021 and 2022



SOURCE: General Administration of Customs of the People's Republic of China (PRC), "Customs Statistics," http://stats.customs.gov.cn; "GAC Data on China's Coal Imports by Country," CEIC, https://www.ceicdata.com; and "Russia's Gas Supplies to China via Power of Siberia Hit 15.5 bcm in 2022, Says Novak," TASS, January 16, 2023, https://tass.com/economy/1562675.

In 2022, the average price of the crude that China imported from Russia was $92 per barrel, whereas the average price of China's total crude imports excluding Russia was $99 per barrel. In January–June 2023, the average price of China's Russian crude imports was $73 per barrel, while the average price of its total crude imports excluding Russia was $80 per barrel. For comparison, in 2021 the average price China paid for a barrel of Russian crude oil was $69, the same as the average price of China's crude oil imports from all other suppliers.[21]

Coal. China's imports from Russia increased by 20% to 68.01 million tons in 2022. This growth expanded Russia's share of China's coal imports from 17.6% to 23.2%, maintaining Russia's position as China's second-largest coal supplier after Indonesia.[22] In January–June 2023, China's imports of Russian coal more than doubled over the same period in 2022 to reach 51.30 million tons, accounting for 24.7% of total imports.[23] Press reports indicate that Chinese buyers have purchased Russian coal at steep discounts.[24]

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21 General Administration of Customs (PRC), "Customs Statistics."

22 This paragraph is based on data from "China Imports 130.47 Million Tons of Lignite in 2022; Import Volume of Coal and Lignite Totals 293.2 Million Tons," Tex Energy, Report, January 30, 2023.

23 General Administration of Customs (PRC), "Customs Statistics."

24 See, for example, Muyu Xu, "China's Coal Imports from Russia Fall in Dec, but Up 20% in 2022," Reuters, January 19, 2023, https://www.reuters.com/markets/commodities/chinas-coal-imports-russia-fall-dec-up-20-2022-2023-01-20; and Su-Lin Tan, "China Continues to Snap Up Russian Coal at Steep Discounts," CNBC, June 29, 2022, https://www.cnbc.com/2022/06/30/china-snaps-up-russian-coal-at-deep-discounts-as-ukraine-war-continues.html.

LNG. In 2022, China's purchases of LNG from Russia jumped 44% to 6.5 million tons. This growth nearly doubled Russia's share of China's LNG imports from 5.7% to 10.3%, moving Russia from China's sixth-largest supplier in 2021 to its fourth-largest supplier in 2022. In January–June 2023, China's imports of Russian LNG increased by 66.2% over the same period in 2022, making Russia China's third-largest supplier of LNG, accounting for 11.6% of total imports.[25]

Pipeline gas. In 2022, China's imports from Russia grew by 49% from 10.4 bcm to 15.5 bcm.[26] This increase raised Russia's share of China's pipeline gas imports from 17.2% in 2021 to 25.0% in 2022.[27] Russia was China's second-largest supplier of natural gas after Central Asia in 2022.[28] The volume of China's pipeline gas imports from Russia in January–June 2023 was not available at the time of writing.

China's increased energy imports from Russia have raised its overall spending on Russian energy resources. China spent $81.3 billion on imports of Russian oil, coal, LNG, and pipeline gas in 2022, up from $52.1 billion in 2021. Most of this money—71.8% (around $58.4 billion)—was used to purchase oil (see **Figure 2**). In January–June 2023, China's spending on Russian energy imports increased by 13.3% over the same period in 2022 from $37.5 billion to $42.4 billion. Coal accounted for most of this growth. By contrast, China's spending on Russian crude declined (see **Figure 3**).[29]

Purchasing of Crude Oil Above the Price Cap

In December 2022, the G-7, the EU, and Australia imposed a price cap of $60 per barrel on Russian seaborne crude oil exports. The goal is to keep Russian oil on the world market while limiting the profits Russia earns from its oil sales. Buyers of Russian crude can only access maritime services for the transport of Russian oil provided by companies domiciled in the price cap coalition countries, which account for around 90% of the market for maritime insurance and reinsurance, if they buy Russian crude at or below $60 per barrel.[30] If a third-party flagged tanker, such as a Chinese-flagged tanker, intentionally carries Russian crude sold above the price cap, price cap coalition countries will be prohibited from providing maritime services to that tanker for 90 days.[31]

China has been purchasing Russian crude above the price cap. The average monthly price it has paid for a barrel of Russian crude has remained above $70 per barrel since December 2022 (see **Figure 4**), as of this writing. This price point is probably because most of China's oil imports from Russia are ESPO crude, a light crude shipped through the ESPO pipeline, which has been trading above the price cap almost every day since it was imposed.[32]

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25 This paragraph is based on data from General Administration of Customs (PRC), "Customs Statistics."

26 "Russia's Gas Supplies to China via Power of Siberia Hit 15.5 bcm in 2022, Says Novak," TASS, January 16, 2023, https://tass.com/economy/1562675.

27 "Russia's Gas Supplies to China via Power of Siberia Hit 15.5 bcm in 2022, Says Novak"; General Administration of Customs (PRC), "Customs Statistics"; and "Energy Production in December 2022," National Bureau of Statistics (PRC), Press Release, January 18, 2023, http://www.stats.gov.cn/english/PressRelease/202301/t20230118_1892302.html.

28 "China's Xi Calls for Greater Cooperation with Turkmenistan on Natural Gas," Reuters, January 6, 2023, https://www.reuters.com/world/asia-pacific/chinas-xi-calls-greater-cooperation-with-turkmenistan-natural-gas-2023-01-06. Central Asia refers to Kazakhstan, Turkmenistan, and Uzbekistan.

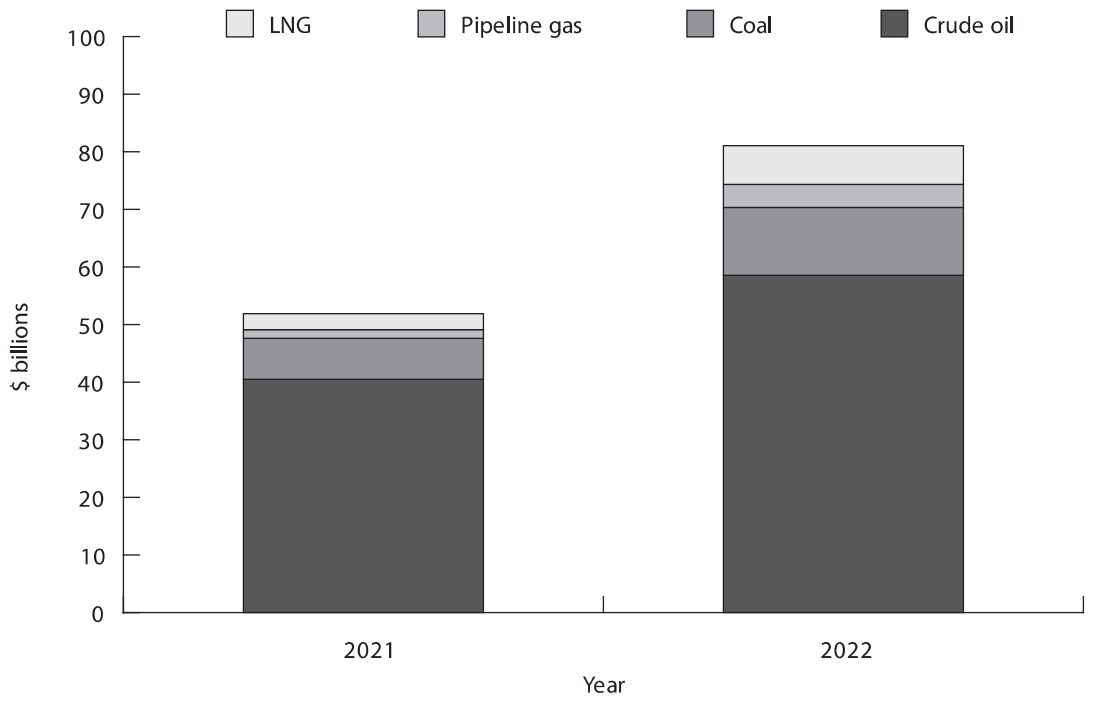
29 General Administration of Customs (PRC), "Customs Statistics."

30 "Fact Sheet: Limiting Kremlin Revenues and Stabilizing Global Energy Supply with a Price Cap on Russian Oil," U.S. Department of the Treasury, Press Release, December 2, 2022, https://home.treasury.gov/news/press-releases/jy1141.

31 Jan Strupczewski, "G7 Price Cap on Russian Oil: What Are the Main Elements," Reuters, December 4, 2022, https://www.reuters.com/business/energy/g7-price-cap-russian-seaborne-crude-oil-main-elements-2022-12-05.

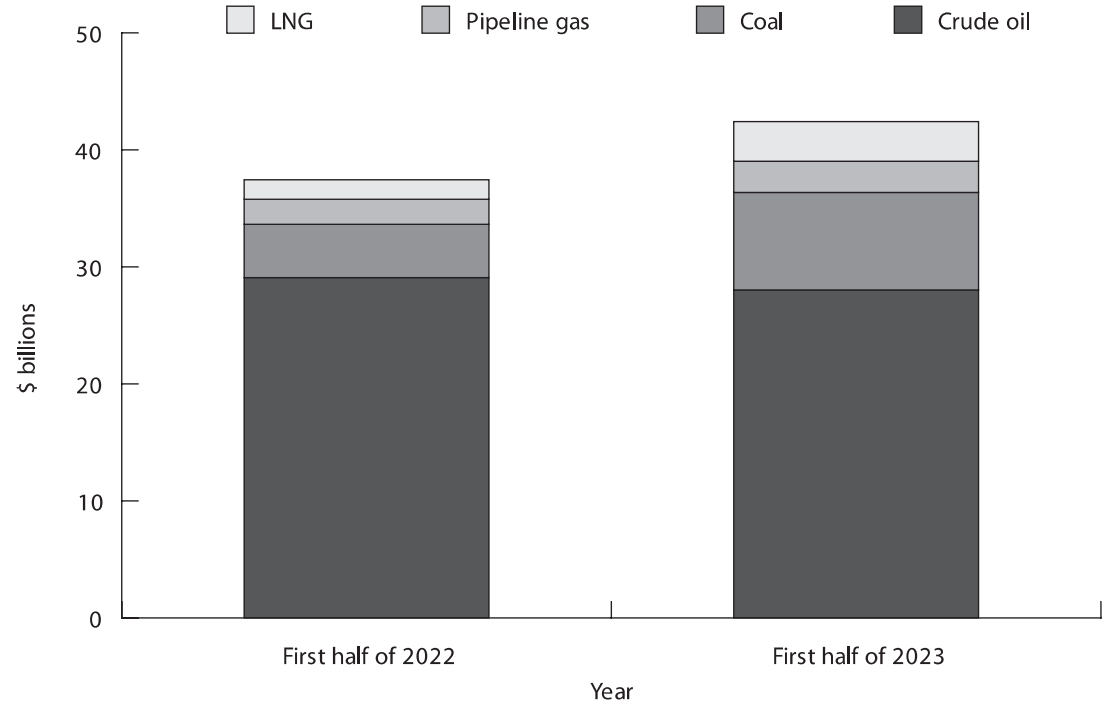
32 Chris Cook and David Sheppard, "Russia Dodges G7 Price Cap Sanctions on Most of Its Oil Exports," *Financial Times*, September 24, 2023, https://www.ft.com/content/cad37c16-9cbd-473c-aa2f-102c21393d2e.

FIGURE 2 Cost of China's energy imports from Russia in 2021 and 2022



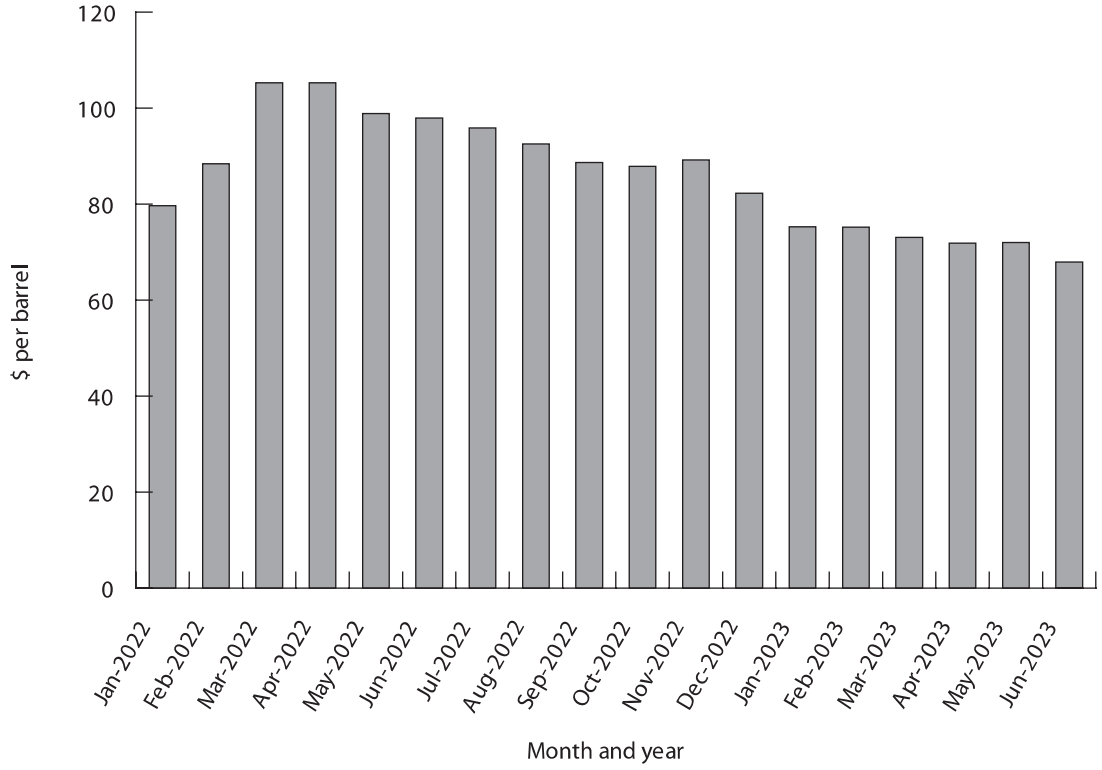
SOURCE: General Administration of Customs (PRC), "Customs Statistics."

FIGURE 3 Cost of China's energy imports from Russia in the first halves of 2022 and 2023



SOURCE: General Administration of Customs (PRC), "Customs Statistics."

FIGURE 4 Average price of China's crude oil imports from Russia



SOURCE: General Administration of Customs (PRC), "Customs Statistics."

Chinese importers are increasingly relying on companies other than China Ocean Shipping Company (COSCO), the owner of China's main state-owned tanker fleet, to deliver Russian oil to China. Research by Henrik Wachtmeister shows that COSCO stopped shipping Russian crude after December 2022 (see **Figure 5**), which probably reflects the company's sanctions concerns.[33] In 2019 the United States sanctioned COSCO subsidiaries for shipping Iranian crude.[34]

Greater Use of the Renminbi for Energy Trade Settlement

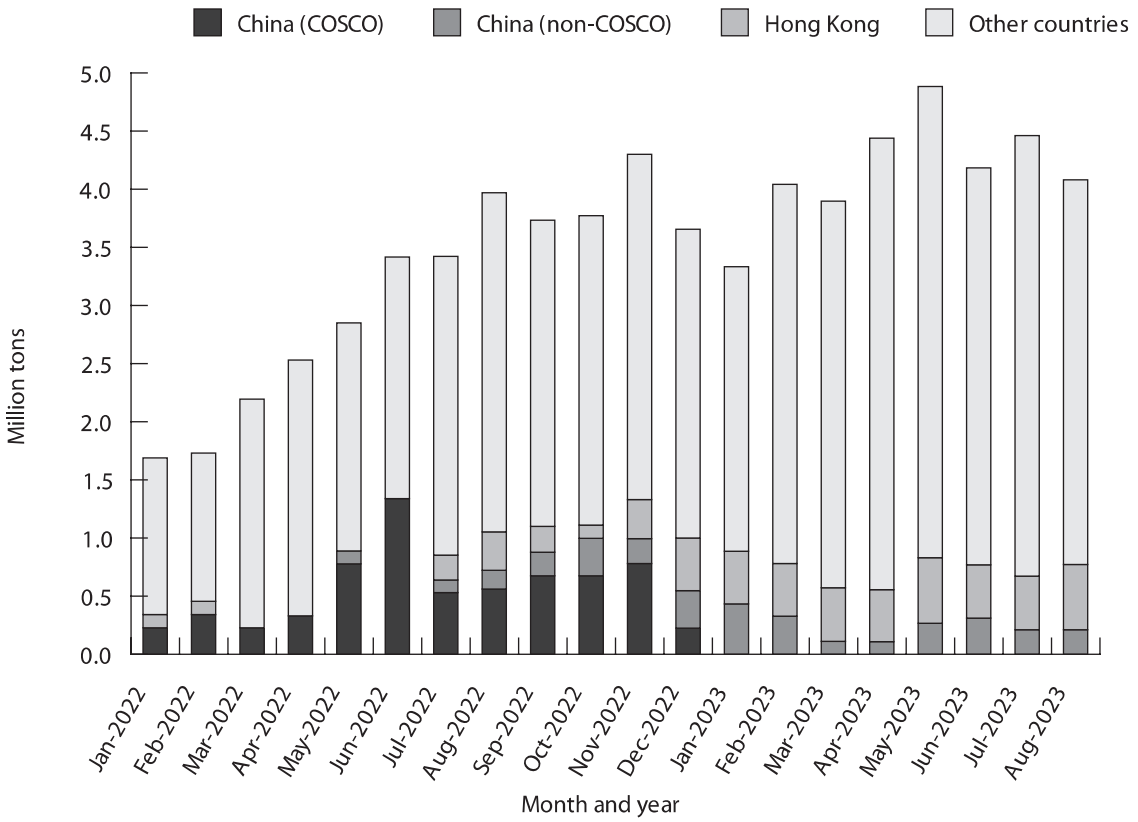
China's use of its own currency to pay for Russian energy imports has increased since the start of the war.[35] In September 2022, President Putin announced that China would pay Gazprom

[33] Henrik Wachtmeister, "Russia-China Energy Relations since 24 February: Consequences and Options for Europe," Swedish National China Centre and Stockholm Centre for Eastern European Studies, Report, no. 1, June 1, 2023, 28, https://www.ui.se/globalassets/ui.se-eng/publications/sceeus/russia-china-energy-relations-since-24-february.pdf. COSCO itself cannot be sanctioned for transporting Russian crude. However, if a COSCO tanker using Western maritime services were to transport Russian crude sold above the price cap, the tanker could lose access to Western maritime services.

[34] Paul Sampson, "Chinese Tankers Stop Loading Russian ESPO Crude," Energy Intelligence, January 11, 2023, https://www.energyintel.com/00000185-9f16-d02f-ad9d-9f765a9b0000; and Michael R. Pompeo, "The United States Imposes Sanctions on Chinese Companies for Transporting Iranian Oil," U.S. Department of State, Press Statement, September 25, 2019, https://2017-2021.state.gov/the-united-states-imposes-sanctions-on-chinese-companies-for-transporting-iranian-oil.

[35] Chelsey Dulaney, Evan Gershkovich, and Victoria Simanovskaya, "Russia Turns to China's Yuan in Effort to Ditch the Dollar," *Wall Street Journal*, February 28, 2023, https://www.wsj.com/articles/russia-turns-to-chinas-yuan-in-effort-to-ditch-the-dollar-a8111457.

FIGURE 5 China's share of Russia-China crude oil shipping



SOURCE: Henrik Wachtmeister, "Russia-China Energy Relations since 24 February: Consequences and Options for Europe," Swedish National China Centre and Stockholm Centre for Eastern European Studies, June 1, 2023, 28, https://www.ui.se/globalassets/ui.se-eng/publications/sceeus/russia-china-energy-relations-since-24-february.pdf; and supplementary data from the Centre for Research on Energy and Clean Air provided by Henrik Wachtmeister.

for natural gas based on a 50-50 split between the ruble and the renminbi.[36] In November 2022, Russian deputy prime minister Alexander Novak said that payments for oil, oil products, and coal were also shifting to national currencies.[37] Six months later, Rosneft, a Russian national oil company, announced that it and CNPC had switched to oil trade settlement in renminbi and rubles.[38] Reuters reported in May 2023 that China had paid for nearly all of its purchases of Russian oil and coal in renminbi.[39]

Moscow and Beijing both have incentives to increase the use of the renminbi in trade settlement. For Russia, payment in renminbi helps reduce its dependence on the U.S. dollar, a

[36] Muyu Xu, "Russia's Gazprom, CNPC Agree to Use Rouble, Yuan for Gas Payments—Gazprom," Reuters, September 7, 2022, https://www.reuters.com/business/energy/petrochina-signs-gas-agreement-with-russias-gazprom-2022-09-07.

[37] "Russia, China Discussing System of Settlements without SWIFT, Mutually Opening Bank Accounts—Novak," Interfax, November 29, 2022, https://interfax.com/newsroom/top-stories/85476.

[38] "Rosneft Says It and China's CNPC Switch to Rouble, Yuan Payments," Reuters, June 16, 2023, https://www.reuters.com/article/russia-china-rosneft/rosneft-says-it-and-chinas-cnpc-switch-to-rouble-yuan-payments-idUKS8N37J09T.

[39] Chen Aizhu, "Vast China-Russia Resources Trade Shifts to Yuan from Dollars in Ukraine Fallout," Reuters, May 10, 2023, https://www.reuters.com/markets/currencies/vast-china-russia-resources-trade-shifts-yuan-dollars-ukraine-fallout-2023-05-11.

process that began after Russia's annexation of Crimea in 2014 and accelerated after Western countries banned Russia's main banks from SWIFT (Society for Worldwide Interbank Financial Telecommunication) in response to the country's invasion of Ukraine.[40] For China, greater use of the renminbi to purchase Russian energy is consistent with Xi Jinping's objective of promoting the internationalization of the currency.[41]

Progress on Arctic LNG 2

Chinese companies are providing equipment to Arctic LNG 2 following the exit of European firms from the project in response to sanctions prohibiting the delivery of goods, technology, and services for natural gas liquefaction in Russia. To be sure, Chinese shipyards stopped the fabrication of modules for Arctic LNG 2 in the second quarter of 2022 partly in response to the sanctions.[42] However, the Chinese shipyards resumed work on the modules in early 2023 on orders from Novatek, with one yard, Penglai Jutal Offshore Engineering, receiving instructions to replace equipment supplied by European companies with equipment from Chinese vendors.[43]

Other Chinese companies are likely to substitute for Western companies in supplying equipment to Arctic LNG 2. For example, Novatek intends to use equipment from China's Wison and Harbin Guanghan to build a gas turbine power plant for the project.[44] Novatek originally intended to purchase the turbines from Baker Hughes, but U.S. sanctions prompted the company to withdraw from the project.[45]

No Progress on Power of Siberia 2

China-Russia energy relations since Russia's invasion of Ukraine in February 2022 are characterized not only by what has happened but also by what has not happened—namely, the signing of a supply contract for the Power of Siberia 2 natural gas pipeline. The project would deliver 50 bcm per year of natural gas from Russia's Yamal Peninsula to China via Mongolia.[46] Gazprom had previously announced plans to launch the pipeline in 2030.[47]

Putin has made little secret of his eagerness to demonstrate progress on Power of Siberia 2, which he described as the "deal of the century."[48] Speaking at the Eastern Economic Forum in Vladivostok in September 2022, he implied that a final agreement was on the horizon, stating

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40 Dulaney, Gershkovich, and Simanovskaya, "Russia Turns to China's Yuan."

41 Xi Jinping, "Hold High the Great Banner of Socialism with Chinese Characteristics and Strive in Unity to Build a Modern Socialist Country in All Respects," Report to the 20th National Congress of the Communist Party of China, October 16, 2022, 28, https://www.fmprc.gov.cn/eng/wjdt_665385/zyjh_665391/202210/t20221025_10791908.html.

42 Xu Yihe, "EU Sanctions Bite: Chinese Yards to Halt Work on Russian Arctic LNG 2 Modules," Upstream, May 10, 2022, https://www.upstreamonline.com/lng/eu-sanctions-bite-chinese-yards-to-halt-work-on-russian-arctic-lng-2-modules/2-1-1214099.

43 Xu Yihe, "Chinese Yards Told to Dismantle Western Equipment as Work on Arctic LNG 2 Modules Resumes," Upstream, January 2, 2023, https://www.upstreamonline.com/exclusive/chinese-yards-told-to-dismantle-western-equipment-as-work-on-arctic-lng-2-modules-resumes/2-1-1381447.

44 Oksana Kobzeva, Vladimir Soldatkin, and Aizhu Chen, "Russia's Arctic LNG 2 Will Use Chinese Equipment for Power Generation," Reuters, May 16, 2023, available at https://www.nasdaq.com/articles/russias-arctic-lng-2-will-use-chinese-equipment-for-power-generation-novatek.

45 "Novatek to Order 1,500-MW Power Plant for Arctic LNG 2 from China's Wison," Interfax, May 16, 2023, https://interfax.com/newsroom/top-stories/90530.

46 Emily Chow, "Explainer: Does China Need More Russian Gas via the Power-of-Siberia 2 Pipeline?" Reuters, March 22, 2023, https://www.reuters.com/business/energy/does-china-need-more-russian-gas-via-power-of-siberia-2-pipeline-2023-03-22.

47 Diane Pallardy, "Gazprom's Plans for Power of Siberia 2 Pipe to China Move Forward," ICIS, March 31, 2020, https://www.icis.com/explore/resources/news/2020/03/31/10488588/gazprom-s-plans-for-power-of-siberia-2-pipe-to-china-move-forward.

48 Chow, "Explainer: Does China Need More Russian Gas via the Power-of-Siberia 2 Pipeline?"

that "all the main parameters" of the deal with China, including price, had been agreed upon.[49] When Xi Jinping visited Moscow in March 2023, Putin made a similar statement, announcing that "practically all the parameters of the agreement have been agreed upon."[50]

It is not hard to understand why Putin wants to portray Power of Siberia 2 as a project with forward momentum. After all, anticipated trade facilitated by the pipeline would partially compensate for the loss of the European market, which accounted for most of the gas produced from the Yamal Peninsula. Before Russia invaded Ukraine, it earned $20 billion per year from sales of 150 bcm to Europe. Sergei Vakulenko, a former head of strategy at Gazprom Neft, a subsidiary of Gazprom, calculates that Russia could earn $2.5 billion to $4.3 billion per year from Power of Siberia 2.[51]

It seems reasonable to speculate that Putin might expect that if Gazprom and CNPC were to sign a supply contract for Power of Siberia 2, it would provide the same favorable political optics for Moscow as the inking of the supply contract for Power of Siberia 1 did in 2014. In May of that year, less than three months after Russia had annexed the Crimean Peninsula from Ukraine, Putin met with Xi in Shanghai, where Gazprom and CNPC finalized an agreement for the Power of Siberia 1 pipeline after more than a decade of negotiations. The signing of the agreement at a time when Russia's relationships with Europe and the United States had deteriorated, and when Russia faced the prospect of additional sanctions for its annexation of Crimea, signaled to the rest of the world that Russia was not internationally isolated and that sanctions would not derail the development of its energy sector.[52]

At present, however, China appears in no hurry to move forward with Power of Siberia 2. When Putin and Xi spoke to the press during the latter's visit to Moscow in March 2023, Putin discussed the pipeline while Xi remained silent on the subject.[53] The reference to Power of Siberia 2 in the joint statement issued by both countries merely stated that the two countries "will work together to promote studies and consultations on the new China-Mongolia-Russia natural gas pipeline project."[54]

China has both geopolitical and commercial reasons for slow-walking Power of Siberia 2. Geopolitically, there may be concerns in Beijing that signing a supply agreement while the war is ongoing might antagonize Europe at a time when Beijing is trying to improve its relations with the region, where China's support of Russia during the war in Ukraine is resented.[55] Indeed, in the wake of Russia's invasion of Ukraine, China is seeking to balance supporting Russia with

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49 "All Main Parameters of Power of Siberia 2 Deal with China Agreed, Including Price—Putin," Interfax, September 7, 2022, https://interfax.com/newsroom/top-stories/82920.

50 "Putin: Russia and China Have Agreed on Nearly All Parameters of Agreement on Power of Siberia 2 Gas Pipeline," Interfax, March 21, 2023, https://interfax.com/newsroom/top-stories/88903.

51 Sergei Vakulenko, "Can China Compensate Russia's Losses on the European Gas Market?" *Moscow Times*, June 15, 2023, https://www.themoscowtimes.com/2023/06/05/can-china-compensate-russias-losses-on-the-european-gas-market-a81374.

52 Thane Gustafson, Zhouwei Diao, and Jenny Yang, "Russia-China Gas Deal: The Winding Road to an Agreement," IHS Energy, Energy Insight, May 23, 2014, 8.

53 "Press Statements by President of Russia and President of China," Kremlin, March 21, 2023, http://en.kremlin.ru/events/president/news/70750.

54 Ministry of Foreign Affairs (PRC), "Zhonghua renmin gongheguo he Eluosi lianbang guanyu Shenhua xin shidai quanmian zhanlüe xiezuo huoban guanxi de lianhe shengming" [Joint Statement between the People's Republic of China and the Russian Federation on Deepening the Comprehensive Strategic Partnership of Coordination in the New Era], March 22, 2023, https://www.fmprc.gov.cn/zyxw/202303/t20230322_11046188.shtml.

55 Steven Erlanger and Erika Solomon, "China Woos European Leaders on Trip Overshadowed by Kremlin Ties," *New York Times*, May 9, 2023, https://www.nytimes.com/2023/05/09/world/europe/china-eu-russia-ukraine-war.html; and Sylvie Zhuang, "For China's European Charm Offensive to Succeed, Its Ukraine War Stance Must Change: Analysts," *South China Morning Post*, May 13, 2023, https://www.scmp.com/news/china/diplomacy/article/3220435/chinas-european-charm-offensive-succeed-its-ukraine-war-stance-must-change-analysts.

stabilizing its relationships with Europe and the United States.[56] Additionally, Beijing might worry that moving forward with such a large and high-profile project would run afoul of U.S. sanctions. China's companies and banks want to avoid engaging in any activities that might do so.[57] Commercially, China is in an even stronger negotiating position than it was in 2014, when it secured a price for Power of Siberia 1 gas that is lower than what China has paid its Central Asian suppliers.[58] It is in Beijing's interest to see what concessions it can extract from Moscow, with new LNG supply deals between Chinese buyers and major exporters such as Qatar and the United States possibly putting additional pressure on Russia to make China an offer it cannot resist.

Conclusion: Implications for the United States

China has approached its energy relationship with Russia since the start of the war with a mix of opportunism and caution. Chinese companies have taken advantage of the discounts on Russian energy to increase their purchases. These increased purchases include ESPO crude priced above the $60 cap. The war has also spurred China and Russia to expand the use of local currencies in trade settlement. But Chinese firms have been careful not to run afoul of Western sanctions. Moreover, China has not yet agreed to Power of Siberia 2, despite Putin's willingness to move forward with the project. These conclusions have four implications for the United States:

China's relationships with the United States and Europe will likely influence the trajectory of China-Russia energy relations. China's efforts to balance its relationships with Russia and the United States and Europe are likely reflected in its caution with respect to sanctions and the lack of progress on Power of Siberia 2. If China's relationships with the United States and Europe were to markedly deteriorate and Beijing were to assess that the rationale for limiting energy ties to Russia had eroded, China might deepen its energy ties to Russia.[59]

China's response to the price cap on Russia's seaborne crude oil exports is a mixed bag for the United States and other members of the price cap coalition. On the one hand, China's increased purchases support the coalition's goal of maintaining the supply of Russian oil to the world market. On the other hand, China's purchases of Russian crude above the $60 price cap do not fully support the coalition's goal of limiting Russia's oil export revenues.

China's LNG buyers are likely to purchase more LNG from the United States.[60] China's LNG importers value the pricing diversity that U.S. LNG provides. Most of China's long-term LNG contracts are indexed to the price of Brent crude, whereas its contracts with the United States are indexed to Henry Hub prices.[61] Additionally, U.S. LNG contracts, unlike many of the other LNG contracts signed by Chinese buyers, provide Chinese firms with flexibility in LNG trading because

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[56] Evan S. Medeiros, "China's Strategic Straddle: Analyzing Beijing's Diplomatic Response to the Russian Invasion of Ukraine," *China Leadership Monitor*, June 1, 2022, https://www.prcleader.org/post/china-s-strategic-straddle-beijing-s-diplomatic-response-to-the-russian-invasion-of-ukraine.

[57] See, for example, Aizhu, "Vast China-Russia Resources Trade Shifts to Yuan from Dollars in Ukraine Fallout."

[58] Vakulenko, "Can China Compensate Russia's Losses on the European Gas Market?"

[59] For a good discussion of this issue, see Wachtmeister, "Russia-China Energy Relations since 24 February," 36–37.

[60] See, for example, Chen Aizhu, Emily Chow, and Marwa Rashad, "China LNG Buyers Expand Trading after Adding More U.S., Qatari Contracts," Reuters, August 21, 2023, https://www.reuters.com/business/energy/china-lng-buyers-expand-trading-after-adding-more-us-qatari-contracts-2023-08-21.

[61] Anne-Sophie Corbeau and Sheng Yan, "Implications of China's Unprecedented LNG-Contracting Activity," Center on Global Energy Policy, Columbia University School of International and Public Affairs, October 7, 2022, 11, https://www.energypolicy.columbia.edu/wp-content/uploads/2022/10/ChinaLNG_CGEP_Commentary_100322-3.pdf.

there are no destination restrictions.[62] This flexibility allowed PetroChina and Sinopec to resell U.S. LNG to Europe in 2022 when demand in Europe was stronger than in China.[63]

The renminbi is unlikely to replace the dollar as the primary currency for energy trade settlement anytime soon. First, China's tightly regulated capital account likely deters energy exporters from holding large amounts of renminbi because it prevents them from freely moving money in and out of China.[64] Before the war, many Russian companies did not want to be paid in renminbi for this reason. Second, major oil exporters, such as Saudi Arabia and the United Arab Emirates, peg their currencies to the U.S. dollar, making oil trade settlement in dollars preferable to other currencies.[65] Third, the fact that the more a currency is used for trade settlement, the more others will want to use it, supports the dollar's continued dominance.[66]

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62 Corbeau and Yan, "Implications of China's Unprecedented LNG-Contracting Activity," 11.

63 See, for example, "China's Energy Giants Sell Gas to World Scrambling for Supply," Bloomberg, May 5, 2022, https://www.bloomberg.com/news/articles/2022-09-06/china-s-energy-giants-sell-gas-to-world-scrambling-for-supply.

64 John Wu, "Chinese Yuan on Slow Path to Globalization Due to Capital Controls," S&P Global, July 11, 2023, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/chinese-yuan-on-slow-path-to-globalization-due-to-capital-account-controls-76484922.

65 Javier Blas, "The Myth of the Inevitable Rise of a Petroyuan," Bloomberg, February 27, 2023, https://www.bloomberg.com/opinion/articles/2023-02-27/pricing-petroleum-in-china-s-yuan-sounds-inevitable-not-for-saudi-arabia.

66 Gerard DiPippo and Andrea Leonard Palazzi, "It's All about Networking: The Limits of Renminbi Internationalization," Center for Strategic and International Studies, April 18, 2023, https://www.csis.org/analysis/its-all-about-networking-limits-renminbi-internationalization.

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Japan's Energy Security Strategy: The Implications of Fukushima and Ukraine

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EXECUTIVE SUMMARY

This essay examines how the 2011 Fukushima Daiichi nuclear disaster, the 2022 Russian invasion of Ukraine, and evolving stakeholder groups' energy resilience priorities are combining to influence the Japanese government's current energy security strategy.

MAIN ARGUMENT

The Fukushima disaster and the war in Ukraine have challenged Japan's energy resource availability and affordability, prompting a shift in the balance of liquefied natural gas (LNG), coal, and nuclear power in Japan's domestic electricity supply. Energy system resilience priorities held by the Japanese government, electric utilities, and the general public also have influenced domestic policy responses and supply strategies. These new initiatives, which include the Economic Security Promotion Act, the 6th Strategic Energy Plan, the Green Transformation (GX) strategy, the GX Decarbonization Electricity Act, the Asia Zero Emissions Community initiative, and other policies and programs, face external and domestic challenges to their focus on balancing energy security, economic, and decarbonization priorities. Food-energy-water-climate interconnections exacerbate these challenges, but potential avenues for international collaboration toward solutions exist. These solutions include clean technology financing and development, continued development of advanced nuclear technologies, enhancements of nuclear safety, nuclear waste disposal solutions, purple hydrogen development, energy storage innovations, sharing of energy efficiency best practices, and responses to supply chain uncertainties for fuels and critical minerals and materials.

POLICY IMPLICATIONS

- Energy shocks and stakeholders' energy system resilience priorities will continue to combine to influence Japan's energy security strategies.
- Recognition of the nexus of food, energy, water, and climate issues in Japan's energy security strategies supports holistic policies and promotes domestic and international collaboration on energy resource diversification, innovation, and clean energy transitions.
- Such integrative policies can include development of synergistic frameworks for energy, food, and water safety and security to address cross-sectoral risks.

Historically, Japan's domestic and international energy policy agendas have been shaped by severe energy resource limitations. The nation has the lowest energy self-sufficiency rate in the G-7, ranging from 10% to 12% in 2019–22.[1] Government and electric utility priorities reflect this energy security vulnerability and its effects on energy system resilience. These energy security priorities combine with an additional economic resilience focus on energy resource prices and recouping energy infrastructure investments.[2]

In this context, a holistic understanding of Japan's current energy security strategy and its intersections with Japanese decarbonization goals requires consideration of the combined effects of two shocks to the nation's energy system: the 2011 Fukushima Daiichi nuclear disaster and the ongoing war between Russia and Ukraine. These events have affected Japan's energy resource availability and affordability, particularly in the context of domestic electricity supply. The Fukushima disaster and ensuing nuclear reactor shutdowns precipitated shifts in policy and electric utility procurement to bolster nuclear safety while promoting an increased use of liquefied natural gas (LNG) and coal to fill the gap in Japan's baseload electricity supply. As of 2021, LNG accounted for approximately 34% of Japan's electricity supply and coal for 34%, with 8.8% of LNG imports and 11% of coal imports coming from Russia.[3] As shown in **Figure 1**, in 2022, LNG still accounted for approximately 32% of Japan's electricity supply, coal for 36%, and nuclear power for 6%.[4]

The impact of the Russia-Ukraine war on LNG and coal availability and pricing has highlighted Japan's energy insecurity and resource vulnerability, exposing the risks of the nation's reliance on imported fuels in times of constrained supply and price fluctuations. These susceptibilities have prompted further shifts in Japanese energy policy, electricity supply source allocations, and electricity rates since early 2022. The war's constraints on critical minerals—necessary components for many renewable energy technologies—also have hindered the Japanese government's plans to advance renewables as replacements for older, inefficient coal plants. Thus, energy security lessons and policy implications from the war involve reshaping the roles of specific electricity supply sources and forming new international partnerships for resource procurement and energy technology development. As the war in Ukraine continues, the energy security and energy system resilience priorities of the Japanese government and Japan's electric power companies remain focused on resource supply stability and the economic implications of investments in LNG, coal, nuclear power, and other sources. These priorities also interact—and are sometimes at odds—with the nationally determined contribution of a 46% reduction in greenhouse gas emissions below 2013 levels by 2030, aiming to achieve carbon neutrality by 2050.[5]

New policies aim to achieve several of the Japanese government's long-standing objectives, including stabilizing fossil fuel supply sources and pricing, addressing utilities' resource investment risks, supporting technological solutions to greenhouse gas emissions from fossil fuels,

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1 Agency for Natural Resources and Energy (Japan), "Japan's Energy: 10 Questions for Understanding the Current Energy Situation (2022 Edition)," February 2022, https://www.enecho.meti.go.jp/en/category/brochures/pdf/japan_energy_2022.pdf.

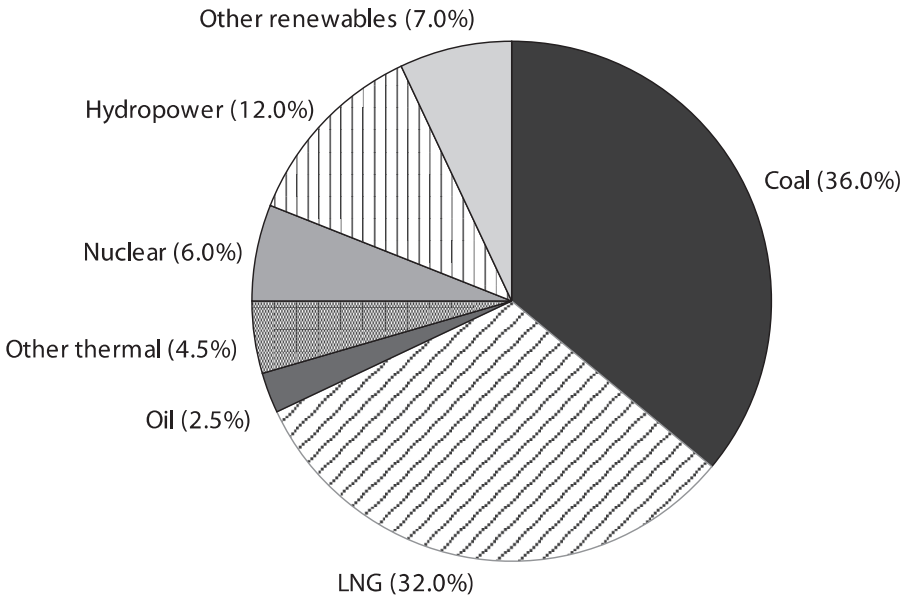
2 Jennifer F. Sklarew, "Power Fluctuations: How Japan's Nuclear Infrastructure Priorities Influence Electric Utilities' Clout," *Energy Research and Social Science* 41 (2018): 158–67; and Jennifer F. Sklarew, *Building Resilient Energy Systems: Lessons from Japan* (Abingdon: Routledge, 2022).

3 Agency for Natural Resources and Energy (Japan), "Japan's Energy."

4 Ministry of Economy, Trade and Industry (METI), "2023 nen 1 gatsu 16 nichi kouhyou jiten no naiyou kekka gaiyou 2022 nen 9 gatsubun" [Content Results of January 16, 2023 Announcement Points: September 2022 Portion], 2023, https://www.enecho.meti.go.jp/statistics/electric_power/ep002/pdf/2022/0-2022.pdf.

5 Government of Japan, "Carbon Neutrality," https://www.japan.go.jp/global_issues/carbon_neutrality/index.html.

FIGURE 1 Japanese electricity supply sources (as of September 2022)



SOURCE: Ministry of Economy, Trade and Industry (Japan), 2023, https://www.enecho.meti.go.jp/statistics/electric_power/ep002/pdf/2022/0-2022.pdf.

and reinstating nuclear power as an emissions-free, primary baseload source with significant prior infrastructure investment.

This essay will examine these shifts in Japanese LNG and coal policies and strategies, as well as the evolving nuclear policy landscape. It then will consider these energy policy changes in the broader context of interconnections with food, water, and climate. The conclusion will focus on implications for Asia-Pacific collaboration to promote regional energy system resilience.

Reliance on LNG

Given the energy security and economic resilience priorities of the utilities and the Japanese government, national policies and plans continue to include LNG as a future power supply source, especially as some nuclear and older coal-fired power plants are decommissioned. Following the Fukushima disaster, the share of LNG in Japan's electricity supply increased from 27% to 38.4% by 2012 and remained at 37.7% in 2020. As the war in Ukraine increased LNG prices and diminished supply, Japan's use slightly declined in 2022 to 32%.[6] In December 2022 the Ministry of Economy, Trade and Industry (METI) announced plans for a program inviting private firms to build six gigawatts of new LNG-fired power capacity by 2030, beginning in the next two years. These plans

[6] International Energy Agency (IEA), "Electricity Information 2023 Edition: Database Documentation," April 2023, http://wds.iea.org/wds/pdf/Ele_documentation.pdf; and METI, "2023 nen 1 gatsu 16 nichi kouhyou jiten no naiyou kekka gaiyou 2022 nen 9 gatsubun."

include subsidies to counter firms' concerns over investment risks in the context of LNG price volatility and global decarbonization trends.[7]

Globally, Japan surpassed China to become the largest importer of LNG in 2022.[8] While Japan primarily imports LNG from Australia and Malaysia, Russia remained its third-largest supplier in early 2023, following a lapse in contracts for imports from Qatar. Prior to the Russia-Ukraine war, the Japanese government generally viewed its LNG supply as stable, highlighting U.S. shale gas production as a driver of this stability, as mentioned in the 6th Strategic Energy Plan. The 2021 plan targets continued use of LNG in Japan's electricity supply and also highlights the need for the diversification of supply sources to mitigate price instability, reflecting policymakers' and utilities' focus on economic resilience.[9] The war in Ukraine altered this perception of supply stability, triggering the creation of new policies to stabilize supply chains. The Agency for Natural Resources and Energy's *Energy White Paper 2022* also highlights the war's exacerbation of LNG price hikes that began during the recovery from the Covid-19 pandemic.[10] The Japanese government and firms in the energy sector have faced an additional energy security challenge with the impending expiration of long-term LNG procurement contracts.[11] Reliance on long-term contracts has left Japanese companies vulnerable at a time when many natural gas suppliers are hesitant to engage in oil-indexed long-term contracts. JERA, a joint venture between Tokyo Electric Power Company (TEPCO) and Chubu Electric Power Company, has partnered with a Taiwanese importer to purchase LNG from Mozambique LNG1 Company Pte. Ltd. As the war in Ukraine has redefined energy security parameters, some Japanese companies have shifted from short-term spot market purchases to new long-term contracts. For example, Mitsui & Co. and JERA have agreed to a ten-year contract to procure LNG from Oman. While seeking contracts with new partners, Japanese companies have reversed their earlier decision not to renew contracts with Qatar based on differences of opinion regarding contract length and destination restrictions. While they have shifted toward long-term contracts with suppliers from the United States and Oman, energy security concerns have driven these firms to negotiate with Qatar regarding new long-term contracts. At the same time, government officials in Brunei, the source of many of the expiring contracts, have affirmed plans to continue supplying LNG to existing Japanese partners.

Recent policies to stabilize fossil fuel supply sources and pricing include measures to diversify sources of energy resources, including gas and oil, as well as other critical materials. One of the broadest of these policies is the Act for the Promotion of Ensuring National Security through Integrated Implementation of Economic Measures (also known as the Economic Security Promotion Act), enacted by the Japanese government on May 11, 2022. The act includes a process through which Japanese companies from designated sectors, including gas, oil, electricity, or one of nine others, can apply for subsidies to cover the diversification of supply sources to protect

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[7] "Gasu karyoku suuki no kensetsu shien, 30 nendo kadou, keisanshou ga kigyou boushuu" [Support for Construction of Several Gas-Fired Units for Operation in Fiscal Year 2030: METI Recruitment of Companies], *Nikkei Shimbun*, December 4, 2022, https://www.nikkei.com/article/DGXZQOFC1418B0U2A410C2000000.

[8] U.S. International Trade Administration, "Japan LNG Supply Chain Developments," September 28, 2022, https://www.trade.gov/market-intelligence/japan-lng-supply-chain-developments.

[9] Government of Japan, "Enerugi-kihon keikaku, reiwa 3 nen 10 gatsu" [6th Strategic Energy Plan], October 2022.

[10] Agency for Natural Resources and Energy (Japan), *Energy White Paper 2022 (Summary)* (Tokyo, June 2022), https://www.meti.go.jp/english/press/2022/pdf/0607_002a.pdf.

[11] Takeo Kumagai and Masanori Odaka, "Commodities 2023: Japan Poised for More Spot LNG Trades as Over 6 Mil Mt/Year Term Supply Expires," S&P Global, November 25, 2022, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/lng/112422-japan-poised-for-more-spot-lng-trades-in-2023-as-over-6-mil-mtyear-term-supply-expires.

against the disruption of supply chains by foreign entities.[12] To promote diversification as an energy importer, the Japanese government is collaborating with other energy-importing nations to encourage energy producers to increase their production and exports while also continuing LNG development cooperation with nations such as the United States and Canada. Japan's Mitsubishi Corporation holds a 15% investment stake in the construction of an LNG port terminal in British Columbia, which is aiming to begin operations in 2025.

The preservation of existing investments in Russian LNG reflects the combined energy security and economic resilience priorities of the Japanese government and private sector. These priorities include energy resource access and pricing, as well as recovery of energy infrastructure investment costs. While diversifying LNG supply sources, the Japanese government and private sector investors have been reluctant to quickly withdraw from investments in Russian LNG supply. In 2022 the Japanese government agreed to reduce oil and gas imports from Russia, but only gradually and incrementally. The government and Japanese private firms have maintained their investments in Russian oil and gas pipeline projects Sakhalin-I and Sakhalin-II, though they have vowed not to commit to new projects in the country. In July 2022, Vladimir Putin forced Japanese partners Mitsui & Co. and Mitsubishi Corporation to renegotiate their investment—12.5% and 10%, respectively—in Sakhalin-II at a higher price, and a new contract was signed in September. In November 2022, the Japanese consortium Sakhalin Oil and Gas Development Co. (SODECO) signed an agreement for investment in Sakhalin-I with the new Russian owner after ExxonMobil withdrew from the project earlier in the year. SODECO owns 30% of Sakhalin-I, and the Japanese government owns half of this stake. The small decline in Japan's Russian LNG imports—only a year-over-year decrease of around 6.8% in April 2023[13]—also reflects the priorities of the Japanese government and private sector. Additional structural changes and policies supporting these priorities emerged in fall 2022 when the Japanese government restructured the Japan Organization for Metals and Energy Security (JOGMEC).[14] The Cabinet approved a measure that allows JOGMEC to buy LNG for Japanese utilities when procurement procedures become difficult.

In addition to diversifying LNG supply sources, the Japanese government has enacted policies to decrease overall dependence on LNG, bolstering energy security while advancing toward carbon neutrality. The revamped JOGMEC incorporates a stronger focus on renewables, including new agency units for hydrogen and offshore wind development, as well as investment in domestic processing of rare metals and overseas development of large-scale geothermal energy. The Japanese government's New Energy and Industrial Technology Development Organization is also supporting the development of alternatives to LNG, coal, and other fossil fuels.

Concurrently, the Japanese government has emphasized ways to integrate LNG into its plans for low-carbon electricity production. Identifying LNG as the lowest-emitting fossil fuel, policies to support technological solutions to greenhouse gas emissions from fossil fuels include the 6th Strategic Energy Plan, the 2022 Green Transformation (GX) strategy, and the Asia Zero Emissions Community initiative. The 6th Strategic Energy Plan includes a description of opportunities for natural gas to support renewable power generation, as well as to employ hydrogen and ammonia co-firing in thermal power plants. The GX strategy aims to counter LNG supply chain uncertainties

[12] A translated outline of the act is available at https://www.japaneselawtranslation.go.jp/outline/75/905R403.pdf.

[13] Japan External Trade Organization, "2022 nendo no Nihon no tai ro boueki, yushutsunyuu tomo ni genshou" [Decline in Japan's Exports, Imports, and Trade with Russia in FY 2022], April 26, 2023, https://www.jetro.go.jp/biznews/2023/04/ade4941ecbb42654.html.

[14] "JOGMEC's New Name, Added Functions, and Reorganization Due to the Revision of the JOGMEC Act," JOGMEC, Press Release, November 14, 2022, https://www.jogmec.go.jp/english/news/release/news_10_00017.html.

and build energy self-sufficiency while simultaneously reducing greenhouse gas emissions. The Asia Zero Emissions Community initiative—along with the Strategic Energy Plan and the GX strategy—supports the continued development and implementation of carbon capture, utilization, and storage (CCUS) to address carbon emissions from both gas- and coal-fired power plants.[15]

The Role of Coal

Coal has played a central role in Japan's electricity supply for decades and was framed as a baseload power source in the government's Strategic Energy Plan even prior to the Fukushima disaster. The percentage of coal in Japan's electricity supply rose from 26%–27% in 2010 to 36% in 2022.[16]

The 6th Strategic Energy Plan balances the economic resilience and energy security priorities pursued by METI and the electric utilities and the decarbonization priorities pursued by the Ministry of the Environment.[17] This confluence of resilience, security, and decarbonization priorities has catalyzed policies, including the GX strategy, that promote the construction of new, more efficient coal-fired power plants; the gradual decommissioning of older, inefficient coal-fired plants; and the development of decarbonization technologies such as CCUS and carbon recycling. The plan also includes a reduced target of 19% coal use in Japan's 2030 electricity supply. Of the 164 coal-fired plants currently operating, the government aims to have the electric utilities retire 100 plants built prior to the mid-1990s. The GX strategy also reflects the goal of replacing older, inefficient coal plants with renewables.

At the 2023 G-7 meeting in Sapporo, four factors—LNG supply and price risks, uncertainty surrounding the pace of Japan's nuclear reactor restarts, the slow expansion of renewable energy, and the historical role of coal in Japan's power supply—combined to fuel Japanese government opposition to the proposal by the United Kingdom and Canada to phase out coal by 2030. Rather than eliminating coal from the electricity supply mix, Japanese utilities are proceeding with the construction of new coal plants. Some of the plants recently completed or under construction utilize ultra-supercritical technology, which uses less coal to produce the same amount of thermal power. The Chugoku Electric Power Company commenced commercial operation of the coal-fired Misumi Power Station Unit 2 on November 1, 2022. The plant, which utilizes ultra-supercritical technology, has a capacity of 1,000 megawatts (MW). Shikoku Electric Power Company commenced commercial operation of Saijo Power Station Unit 1, a 500 MW plant, in June 2023.[18] JERA commenced trial operation of Yokosuka New Unit 1 (650 MW) and Taketoyo (1,070 MW) in 2022. Four additional coal plants are under construction or planned to commence operation by 2026, including JERA's 650 MW Yokosuka New Unit 2 and J-Power's 500 MW GENESIS Matsushima Unit 2. All of the newer plants are more energy-efficient. However, their larger capacity also means that they produce more net emissions than the older, less efficient plants

[15] For more details on the initiative and its role in advancing cooperation with other Asian nations, see Government of Japan, "Clean Energy Strategy to Achieve Carbon Neutrality by 2050," June 23, 2022, https://www.japan.go.jp/kizuna/2022/06/clean_energy_strategy.html.

[16] IEA, "Electricity Information 2023 Edition"; and METI, "2023 nen 1 gatsu 16 nichi kouhyou jiten no naiyou kekka gaiyou 2022 nen 9 gatsubun."

[17] Sklarew, *Building Resilient Energy Systems*.

[18] "While the World Phases Out Coal, More Coal-Fired Power Plants Start Up in Japan," Japan Beyond Coal, November 11, 2022, https://beyond-coal.jp/en/news/misumi-saijo_nov2022.

they are replacing. This continued reliance on coal, despite the utilization of new technology, will pose an ongoing challenge to Japan's climate goals.

As discussed earlier, the war in Ukraine has generated coal supply and pricing complications for Japan, challenging governmental and utility priorities for economic resilience and energy security. These pressures arise in part due to sanctions imposed by Japan in alignment with other G-7 nations. In April 2022 the Japanese government announced a gradual ban on Russian coal imports.[19] A few months later, JERA ceased Russian coal procurement, despite the launch of Yokosuka New Unit 1 and Taketoyo. Other energy importers and electricity producers are following at a slower pace.

This policy to eliminate Russian coal imports hinders the Japanese utilities' planned introduction of new coal plants, posing further barriers to Japan's energy security and resilience priorities. At the same time, efforts by the Japanese government and energy industry to diversify coal supply sources and reduce Russian coal imports have yielded more significant results than the aforementioned endeavors to diversify LNG sources. In 2020–21, many of the electric utilities relied on Russia for 7%–10% of their coal supply. According to data from the Ministry of Finance, Japan's coal imports from Russia have declined dramatically—by 73% in February 2023 year-over-year and by 36% in January–March 2023 year-over-year.[20] This has coincided with increases in imports from Indonesia, Canada, Australia, South Africa, and the United States.

Supply limitations to Japan's baseload electricity supply sources (nuclear, coal, and LNG), coupled with higher LNG and coal prices, spurred electric utilities to request hefty electricity rate increases in 2022. Seven utilities sought METI approval for a 28%–48% rate increase,[21] but the ministry approved smaller increases ranging from 14% to 42%, implemented in summer 2023.[22] As shown in **Table 1**, the utilities with the largest percentages of imported fossil fuels in their electricity generation received approval for the highest rate increases. Hokuriku Electric, which produces almost 80% of its electricity from LNG, coal, and oil, received approval for a 42% rate increase. Similarly, Okinawa Electric, which produces 94% of its electricity from LNG, coal, and oil, was approved for a 38% rate increase.

The conundrum of the combined effects of the war in Ukraine, the Fukushima disaster, and the need to address climate change became even more apparent in discussions during the 2023 G-7 Summit hosted by Japan. The resulting communiqué commits "to holistically addressing energy security, the climate crisis, and geopolitical risks," highlighting intentions to constrain energy imports from Russia, eliminate unabated coal-fired power production (i.e., coal plants that do not incorporate CCUS), advance renewables and clean hydrogen, and support safe, long-term use of nuclear power.[23]

As mentioned, following the Fukushima disaster, LNG and coal have replaced a significant portion of the absent nuclear power in Japan's electricity supply. However, the roles of both fossil

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[19] Fumio Kishida, "Press Conference by Prime Minister Kishida," Prime Minister of Japan, April 8, 2022, https://japan.kantei.go.jp/101_kishida/statement/202204/_00004.html.

[20] Ministry of Finance (Japan), "Trade Statistics of Japan," https://www.customs.go.jp/toukei/srch/indexe.htm.

[21] Three utilities did not request increases: Chubu Electric, Kansai Electric, and Kyushu Electric. The Japan Fair Trade Commission (JFTC) found that these companies violated the Anti-Monopoly Act in 2018–20 through cartel formation to preserve their monopoly status and higher electricity rates. "The JFTC Issued Cease and Desist Orders and Surcharge Payment Orders against the Former General Electricity Utilities, etc.," JFTC, Press Release, March 30, 2023, https://www.jftc.go.jp/en/pressreleases/yearly-2023/March/230330.html.

[22] METI, "Denki ryoukin no kaitei ni tsuite" [Regarding Revision of Electricity Rates (June 2023)], June 15, 2023, https://www.enecho.meti.go.jp/category/electricity_and_gas/electric/fee/kaitei_2023.

[23] "G-7 Hiroshima Leaders' Communiqué," Ministry of Foreign Affairs (Japan), May 20, 2023, https://www.mofa.go.jp/files/100506907.pdf.

TABLE 1 Japanese electric utilities' rate increases and reliance on imported fossil fuels (2020–22)

Utility	Requested rate increase	Approved rate increase	% electricity from LNG + coal + oil	Procurement from Russia
Chugoku	34%	29%	~65.4%	Yes
Hokkaido	32%	21%	~57.0%	Yes
Hokuriku	48%	42%	~79.3%	No
Okinawa	42%	38%	~94.0%	Yes (through Osaka Gas)
Shikoku	29%	25%	~37.7%	Yes
TEPCO	28%	14%	~94.0%	Yes (JERA)
Tohoku	32%	24%	~69.0%	Yes

SOURCE: METI, "Denki ryoukin no kaitei ni tsuite (2023 nen 6 gatsu jisshi)" [Regarding Revision of Electricity Rates (June 2023)], June 15, 2023, https://www.enecho.meti.go.jp/category/electricity_and_gas/electric/fee/kaitei_2023; "Gasu karyoku suuki no kensetsu shien, 30 nendo kadou, keisanshou ga kigyou boushuu" [Various Gas Thermal Power Facilities Support: METI Recruits Corporations for FY2030 Operation], *Nikkei Shimbun*, December 4, 2022, https://www.nikkei.com/article/DGXZQOFC1418B0U2A410C2000000; Shingo Hashitani and Naoki Kawaguchi, "Okinawa Power Industry Looks to Reduce Reliance on Fossil Fuels," *Japan News*, March 11, 2022, https://japannews.yomiuri.co.jp/features/japan-focus/20220311-14594; "Osaka Gas Signs Heads of Agreement with Okinawa Electric," Osaka Gas, May 13, 2010, https://www.osakagas.co.jp/en/whatsnew/1209738_11885.html; Shikoku Electric Power Group, "Shikoku Electric Power Group Integrated Report 2022," September 2022, https://www.yonden.co.jp/english/ir/tools/ann_r.html; "Shikoku Denryoku: Roshia kara no sekitan yunyuu nit suite 'rainendo wa shinchou ni kentou'" [Shikoku Electric "Cautiously Examining Next Fiscal Year" Regarding Fossil Fuel Imports from Russia], KSB 5ch, February 28, 2022, https://news.ksb.co.jp/article/14559998; Tokyo Electric Power Company Holdings, "ESG Data 2022—Environmental Data," updated May 2023, https://www.tepco.co.jp/en/hd/about/esg/pdf/Environmental_data_2022_eng.pdf; and Tohoku Electric Power Group, "Tohoku Electric Power Group Integrated Report 2022," September 2022, https://www.tohoku-epco.co.jp/ir/report/integrated_report/pdf/tohoku_report2022en.pdf.

fuels in Japanese energy security strategy reflect expectations of an eventual return to nuclear power. No Strategic Energy Plan since the disaster—including the plan released in 2021—depicts natural gas as a baseload source. The 2014 and 2018 plans describe it as an "intermediate power source" and, along with the 2021 plan, include a 27% target for LNG in Japan's electricity supply by 2030.[24] In 2020, natural gas accounted for 37.7% of Japan's electricity supply, dropping to 32% by early 2023. While coal has retained a baseload role, a sizable gap in the power supply remains, even as increasing use of renewables aims to replace some of the older coal plants. Japanese policymakers aim to revitalize nuclear power to fill this gap.

[24] Government of Japan, "Enerugi-kihon keikaku, heisei 26 nen 4 gatsu" [4th Strategic Energy Plan], April 26, 2014, 25; and Government of Japan, "Enerugi-kihon keikaku, heisei 30 nen 7 gatsu" [5th Strategic Energy Plan], July 30, 2018, 20.

Nuclear Shifts

Shared governmental and utility priorities focused on energy security and economic resilience, coupled with national decarbonization goals, frame a continued role for nuclear power. In the context of rebuilding public trust, Japan's 6th Strategic Energy Plan includes the "stable use of nuclear power" without mentioning new reactor construction or expansion of nuclear power.[25]

While the Fukushima disaster led to a dramatic decline in public support for nuclear power, the war in Ukraine has revived support in order to decrease dependency on gas imports from Russia, as seen in several public opinion polls conducted in 2022. A March 2022 *Nikkei* poll shows an increase in support for restarting nuclear reactors to 53%, compared with 46% in September 2021. Likewise, a July 2022 Jiji Press poll found that 47% supported restarts. On nuclear reactor license extensions and new nuclear construction, a September 2022 NHK poll found that support reached 45% and 48%, respectively. These figures represent a leap forward in public support for nuclear power compared with previous years since the Fukushima disaster.

This upswell in public support for nuclear power has enabled the emergence of several new policies that facilitate its return to a significant role in Japan's electricity supply and decarbonization strategy. These new policies aim to bolster Japan's energy security while also addressing the electric utilities' economic resilience concerns regarding prior and future investments in nuclear infrastructure.

The Basic Policy for the Realization of GX, approved by the Cabinet in early 2023, includes measures to restart existing nuclear reactors and construct new reactors to replace those slated for decommissioning. As of June 2023, ten reactors have resumed operation, all of which are pressurized water reactors. Seven reactors already have passed the safety reviews conducted by the Nuclear Regulation Authority: five boiling water reactors and two pressurized reactors. The Nuclear Regulation Authority is currently reviewing an additional ten reactors, and the electric utilities are preparing for the construction of eight new reactors. In addition to the Fukushima Daiichi and Daini reactors, eleven older reactors will be decommissioned. Many of these decisions reflect the utilities' focus on economic resilience, given the cost of upgrades to meet safety standards implemented following the Fukushima disaster.[26]

The policy package accompanying the GX basic policy also involves revised parameters for extending the license of aging reactors, plans for new reactor construction, and support for the backend of the nuclear fuel cycle. On April 27, 2023, the Lower House passed the Bill to Partially Amend the Electricity Business Act, etc. to Establish an Electricity Supply System for the Realization of a Decarbonized Society (GX Decarbonization Electricity Act). The other amended nuclear-related acts in the legislation include the Basic Act on Atomic Energy; the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (also known as the Reactor Regulation Act); and the Spent Nuclear Fuel Reprocessing Fund Act. The bill, which supports the GX strategy, contains several provisions on extending nuclear reactor licenses and constructing new reactors.

One of these measures extends the operational licenses for current nuclear power plants beyond their current 60-year term by excluding from the limit any periods when reactors were (or are) offline. This policy enables more reactors to remain operational through 2050, the target year for

[25] Government of Japan, "Enerugi-kihon keikaku, reiwa 3 nen 10 gatsu."

[26] Sklarew, *Building Resilient Energy Systems*.

Japan's decarbonization efforts. It also includes unlimited nuclear plant license extensions every 10 years after the first 30 years of operation, contingent on the Nuclear Regulatory Authority's approval of reactor condition and safety at each 10-year mark. Additionally, the new policy contains provisions that support the construction of advanced nuclear reactors to replace those slated for decommissioning. Reactor types will include advanced light-water reactors, miniaturized reactors, high-temperature gas-cooled reactors, and prototype fast reactors. International cooperation agreements complement these measures. Plans for collaboration were announced in January by U.S. secretary of energy Jennifer Granholm and METI minister Yasutoshi Nishimura and will focus on the development and construction of next-generation advanced reactors, including small modular reactors.

The policy's provisions on the backend of the fuel cycle aim to address energy security, waste disposal, and investment risks through continued support for long-term plans to develop domestic reprocessing and use the resulting mixed oxide fuel in reactors. The Rokkasho reprocessing plant in Aomori Prefecture passed the Nuclear Regulation Authority's review in July 2020, and the earliest predicted completion date for the plant is April–June 2024.[27] The Federation of Electric Power Companies expects the accompanying facility for mixed oxide fuel fabrication, which passed the Nuclear Regulation Authority's review in December 2020, to be completed within the same time frame.

Japanese public support for policies advancing nuclear power is rising; however, local fisheries and the National Federation of Fisheries Cooperatives, as well as the governments of China and South Korea, have opposed the Japanese government's plans to release more than 1.3 million tons of stored, contaminated water from the Fukushima Daiichi disaster. The water has been treated but still contains tritium. The Nuclear Regulation Authority approved the plan on May 10, 2023, and on July 4, 2023, the International Atomic Energy Agency determined that the plan meets international safety standards.[28]

Energy Security Interconnections with Food, Water, and Climate

The conundrum regarding the Fukushima disaster's ongoing potential impacts on food and water safety reflects the broader interconnections of energy, food, water, and climate issues. In particular, public perceptions of water and food risks emerging from the Fukushima disaster have challenged the Japanese government's advancement of policies to preserve nuclear power as a joint solution to achieve energy security and decarbonization goals. The war in Ukraine has revealed a different set of interconnected energy, food, and water risks through supply chain vulnerabilities.

As the release of Fukushima reactor water demonstrates, policies to address energy security shocks such as the Fukushima disaster and the war in Ukraine have implications beyond energy security. These policies also affect the food and water sectors, as well as climate change mitigation efforts. Changes in Japanese energy policy in response to these two shocks have had a mixed effect on the climate aspect of the food-energy-water-climate nexus. The replacement of nuclear power with LNG and coal following the Fukushima disaster has challenged the Japanese government's

[27] "Electricity Review Japan 2023," Federation of Electric Power Companies of Japan, March 31, 2023, https://www.fepc.or.jp/english/library/electricity_eview_japan/index.html.

[28] "IAEA Finds Japan's Plans to Release Treated Water into the Sea at Fukushima Consistent with International Safety Standards," International Atomic Energy Agency, Press Release, July 4, 2023, https://www.iaea.org/newscenter/pressreleases/iaea-finds-japans-plans-to-release-treated-water-into-the-sea-at-fukushima-consistent-with-international-safety-standards.

decarbonization targets. Likewise, the war in Ukraine's impacts on LNG supplies have contributed to the preservation of plans for new coal-fired power plant construction, further hindering emissions reductions. At the same time, complementary policies supporting the return of nuclear power as a baseload electricity supply source promote the government's decarbonization goals as well as energy security.

Concurrently, the Fukushima disaster and the Russia-Ukraine war have affected the security of Japan's energy, water, and food in ways that require integrative solutions. Addressing the food and water contamination challenges arising from the Fukushima disaster has required regulatory changes, while the war in Ukraine has exacerbated uncertainties in energy and food supply chains. These intertwined challenges suggest the need for coordination across regulatory authorities and the development of synergistic frameworks for energy, food, and water safety and security to address cross-sectoral risks.[29]

Conclusion: Implications for Asia-Pacific Collaboration

The challenges from the Fukushima disaster and the war in Ukraine provide opportunities for Japan to collaborate with its Asia-Pacific partners. Energy security complications from the war in Ukraine have provided the Japanese government with an opportunity to deepen cooperation with the United States and other nations to promote energy resource diversification, innovation, coordinated responses to threats, and clean energy transitions. Relevant partnerships include collaboration with the United States and similarly resource-constrained South Korea, as well as with the United States, India, and Australia through the Quad. More recently, the Indo-Pacific Economic Framework for Prosperity has emerged as a tool for addressing these challenges. Promising areas of collaboration include clean technology financing and development, advanced nuclear technologies, nuclear safety, nuclear waste disposal, purple hydrogen, energy storage, sharing of energy efficiency best practices, and responses to supply chain uncertainties for fuels and critical minerals and materials. Building on these existing partnerships will bolster collective energy security, contribute to addressing climate change, and help mitigate economic challenges facing the development of resilient energy systems.

Public support for Japan's recent energy policies has emerged from recognition of the energy system resilience risks revealed by the war in Ukraine. The public's energy resilience priorities thus currently overlap with the government's, especially in regard to electricity prices and electricity access. While deepening collaboration with its international partners, the Japanese government can leverage this public support to advance additional domestic policies that jointly promote energy security and decarbonization. These international and domestic efforts will combine to enhance holistic energy system resilience domestically and regionally.

[29] For more details, see Sklarew, *Building Resilient Energy Systems*.

THE NATIONAL BUREAU *of* ASIAN RESEARCH

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Going Green in India: Balancing Energy Security and the Energy Transition

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EXECUTIVE SUMMARY

This essay examines India's energy security in the short and medium term and finds that development needs will drive the country's energy policy, which balances energy security with the energy transition.

MAIN ARGUMENT

India's current energy policy comprises parallel strategies of aggressively going green while continuing to harness traditional fossil fuels. In light of trends in 2022, where energy security was paramount worldwide and Europe fell back on increased coal use as Russian natural gas supplies were cut off, India is even less apologetic for its strategic use of coal, which, though polluting, is accessible and tightly intertwined with its economy. India has ambitious renewable energy (RE) plans. Its 2030 targets require almost 40 gigawatts per year of additional capacity of wind and solar. This is just under 10% of present installed total capacity in the country, for the fourth-largest grid in the world (behind China, the U.S., and the European Union). Increasing the share of RE in the grid strengthens domestic, low-carbon energy security to the extent that it reduces reliance on alternative fossil fuels, such as coal. However, it does not ensure overall energy security due to RE's inherent variability and the reality that the required energy storage technologies to address this variability are still not cost-effective at scale.

POLICY IMPLICATIONS

- India's 2070 deadline for net-zero emissions, combined with the fact that its emissions today are already half the world average, means that energy use and carbon emissions will grow for some time before they can peak.
- Achieving its RE targets will require India to leverage private sector capital as well as financing from the international community. In particular, storage technologies are needed to handle the intermittency of RE, which is currently expensive and is expected to remain so in the near term.
- India is eager to reduce its reliance on imported fossil fuels, but this is a long-term ambition. The country still lacks secure and inexpensive domestic natural gas and thus faces ongoing challenges in expanding the use of natural gas.

India is the fifth-largest economy and recently surpassed China to have the largest population in the world. However, on a per capita basis, its development indicators are well below the world average, spanning GDP, energy use, and CO_2 emissions. Thus, energy growth and sufficiency are the overriding objectives for the country's energy policy, something the government calls "inclusive energy for all."

This essay examines the various facets of India's energy policy and expected trajectory and assesses whether there are trade-offs among the various objectives that include affordability, security, and sustainability—the so-termed energy trilemma. The first section provides background on India's present status, which shows the dominance of fossil fuels, especially coal and petroleum. The essay then considers the energy transition in detail, especially in the power sector, where renewable energy (RE) represents the majority of growth for energy investments in the country. It next asks whether RE can provide energy security, a question inherently linked to scalability. The essay concludes with a list of challenges and policy choices for India as it balances the various objectives of its energy policy.

India's Energy Security Trajectories in Context

Historically, India's domestic energy security strategy has focused on available energy supply, with a heavy emphasis on access to fossil fuels. Electricity is one of India's most important forms of energy, and the largest share of commercial primary energy used to generate it is coal, which produces roughly half of the country's CO_2 emissions. Given its dependence on fossil fuels, India has some of the most ambitious targets for RE in the world, especially when accounting for grid size. The country plans to expand wind and solar capacity by around 3.5 times between fiscal year (FY) 2023 and FY 2030. However, even then the National Electricity Plan from the Central Electricity Authority projects that by 2032 50% of the electricity would still come from coal.[1] This is much lower than the almost 75% that the Central Electric Authority shows coming from coal today, but the plan still shows a modest (20%) increase in coal capacity through 2032.[2]

In FY 2022, 88% of India's crude oil was imported, and while this represents a security risk in theory, global oil supply chains are relatively abundant and easily rerouted or changed, unlike access to natural gas. The biggest risks for imported fossil fuels remain price volatility and shocks, as was felt worldwide in the aftermath of the Russian invasion of Ukraine. Some European countries have offset the drop in their Russian natural gas imports with coal. India has modest coal imports given that it has large supplies of coal,[3] and it is the second-largest consumer of coal in the world. From a climate change perspective, coal is certainly the worst of the fossil fuels, but India's use of other fossil fuels is low compared with global averages. When adjusting for population size as well as coal quality (energy content per ton), India's coal use was only roughly half the global average in 2019 (see **Table 1**). Due to these factors, the country's per capita CO_2 emissions are below half the world's average.

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[1] Central Electricity Authority (India), *National Electricity Plan*, vol. 1, *Generation* (New Delhi, May 2023), https://cea.nic.in/wp-content/uploads/notification/2023/06/NEP_2022_32_FINAL_GAZETTE_English.pdf.

[2] It is only with sustained growth of RE and a plateau of coal power capacity that the output of solar approaches that of coal, after almost two decades. See, for example, the models in International Energy Agency, "India Energy Outlook 2021," February 2021, https://www.iea.org/reports/india-energy-outlook-2021.

[3] Most coal imports are for niche users, such as at coastal power plants, or for metallurgical (i.e., coking) coal, which has limited domestic availability.

India's energy security strategy is defined by the need for sustained and high growth in modern energy services. This is inevitable given the currently low base of these services. For example, India's electricity consumption per capita is only one-third of the world average.

India is striving to decouple energy demand from greenhouse gas emissions, which must decrease even as energy demand continues to rise. Recognizing this challenge, India's energy policies reflect a more realistic expectation of relative improvement in the near term. For example, the country's pledge at the 2015 UN Climate Change Conference in Paris (COP21) to reduce emissions intensity of GDP by 33%–35% by 2030 was subsequently upgraded at the 2021 meeting in Glasgow (COP26) to 45% by 2030. This accounts for increasing reliance on RE, improving end-use efficiency, decreasing and then phasing out coal, and other shifts in domestic energy supply.

Before unpacking the implications of these plans for energy security, it is worth noting that India is starting in a different place from the Organisation for Economic Co-operation and Development (OECD) countries, which are high emitters of CO_2. For these countries, achieving the pledge of zero emissions by 2050 translates into an annual emissions reduction of 3.3% (using 2020 as a starting point). Although the emissions of many OECD countries peaked over a decade ago, their annual emissions reductions have been far short of 3.3%. In contrast, for a country like India with a low emissions base and a longer horizon to achieve zero emissions, this means that near-term emissions will likely increase over the next few years as energy grows before decreasing.[4]

TABLE 1 Global snapshot of top producers/consumers of coal (2019)

	Production (MT)	Consumption (MT)	Per capita coal consumption (kg)	Estimated average calorific value (kcal/kg)	Converted per capita coal energy consumption (GJ)	Share of primary energy from coal
China	3,846	3,936	2,826	4,958	59	57.6%
India	756	966	714	4,021	12	47.7%
United States	640	507	1,553	5,340	35	12.0%
Germany	134	244	2,941	2,257	28	17.5%
Russia	440	174	1,202	4,991	25	12.2%
South Africa	254	161	2,789	5,655	66	70.6%
Indonesia	610	138	516	5,894	13	38.2%
Poland	112	115	6,284	3,975	105	44.7%
Kazakhstan	115	93	2,442	4,307	44	53.9%
Australia	507	69	2,751	6,199	71	27.8%
Colombia	82	9	180	6,871	5	13.4%
Rest of world	632	1,937	505	3,678	8	12.4%
Total world	*8,129*	*7,658*	*1,009*	*4,925*	*21*	*27.0%*

SOURCE: Rahul Tongia, "'King Coal' Isn't Dead, but Future Indian Coal Won't (and Shouldn't) Look Like It Did in the Past," in *Future of Coal in India: Smooth Transition or Bumpy Road Ahead?* ed. Rahul Tongia, Anurag Sehgal, and Puneet Kamboj (Chennai: Notion Press, 2020).

[4] The Central Electricity Authority's National Electricity Plan (2023) projects that electricity growth will average 6% annually through FY 2032.

Growth based on clean energy alone becomes even more complex because many developing countries, including India, have traditionally been deficient in electricity supply. Electricity is unique because it is difficult to store, and providers need facilities and supplies on standby to instantaneously and continuously meet demand. By comparison, many OECD countries not only have a buffer for capacity but also are decreasing overall electricity demand through energy-efficient methods (and because they are starting from a high base of consumption). This makes it far easier to handle the inherent uncertainty in clean energy systems, especially wind and solar power. For instance, many Western European nations relied on dispatchable "firm" backup capacity, such as natural gas, as they developed RE.

The last difference worth noting is the relative importance of energy security. India, like many other developing countries, does not have universal access to modern energy services. For example, a large percentage of rural cooking is still done via biomass. While India currently has virtually 100% household electrification,[5] reliable around-the-clock electricity is still a work in progress. However, supply has improved dramatically over the last decade, before which load-shedding was routine and considered a viable coping measure for a lack of energy supply.

Energy security (i.e., a reliable supply of electricity) is thus elusive for some end-users and imposes huge burdens in terms of productivity and the need for backup power. In this scenario, improved energy security takes priority over decarbonizing the energy supply mix. Decarbonization remains important, but in many cases it is still a longer-term objective for India and secondary to more immediate energy security needs.

Can Clean Energy Suffice?

The Energy Trilemma

The well-known energy trilemma (affordability, reliability, and sustainability) is understood differently in India than in more developed nations with high per capita energy consumption (and thus emissions).[6] A relevant adage comes from the information technology sector: "cheaper, faster, better—pick any two." "Better" within the context of energy supplies can encompass not just sustainability or security but also many technical and social dimensions, such as the degree of local employment or consumer choice. But "faster" can be re-envisaged as faster scale-up, something that reflects the development imperative. With decarbonization ambitions, disproportionate growth is expected in the electricity sector. This is where clean energy technologies present several challenges. RE is relatively fast to deploy, but it is a relatively diffuse technology. This is especially true of solar, which is India's leading form of RE. It also operates at a much lower capacity utilization factor than coal, India's mainstay. Consequently, for the same annual generation of electricity via coal, around three times as much solar capacity would be needed. In addition to the differences in capacity requirements between RE and coal, the investment implications are also different. Given that wind and solar are capital expenditures with nearly zero fuel costs, their expenses are entirely upfront, even if they save money over their lifespan.

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[5] The government's portal for electrification indicates 99.99% household electrification, primarily driven by the SAUBHAGYA scheme, which electrified over 26 million households in just a few years.

[6] CO_2 emissions can be benchmarked by comparing national emissions per capita to the world average. India emits less than half the world average, and many sub-Saharan countries emit multiple times lower. In contrast, China is approaching double the world average.

While the market can figure out some of these details, there are more subtle structural and institutional factors at play. As of August 2023, 97% of RE in India is from the private sector,[7] which still needs to navigate the highly regulated power system, especially when it comes to access to transmission and power purchase agreements—not to mention issues like land acquisition. While coal also requires significant land, most of this is not at the power plant level, and the majority of fuel supply is from state-owned enterprises.

The last challenge that RE faces is one of suitability for meeting demand, which manifests most clearly in its inherent characteristics of variability and lack of viable storage options. This is one reason that Indian utilities still look to coal in periods when RE is unavailable, such as during the evening peak hours. Storage technologies are still measurably more expensive than coal-based power.[8]

Complexities of Capacity, Fuel, Delivery, and Price

Almost all energy forms operate in an ecosystem. While generating power from wind and solar does not require input fuels like oil or coal, the process still requires equipment such as turbines or photovoltaic (PV) cells, which involves manufacturing and materials. Once built, renewable sources are not at risk of traditional fuel supply disruptions, but the degree of energy output depends on the availability of wind and sunlight, a conundrum referred to as "variability." Solutions to variability include oversizing (also termed overengineering), adequate storage, and a contingency fuel on standby. All of these are expensive, and the third option has other complications. In terms of backup fuels, India's power grid is heavily coal-based, and coal power plants are less flexible than natural gas plants. However, India has limited domestic natural gas resources, which are largely used for fertilizer and city gas networks and transportation. Due to these domestic priorities, facilitating grid flexibility—a key element for grid security—becomes harder.

India's recent challenges with grid supply and power shortfalls were not about having too few coal power plants but about having insufficient coal at them. India's 24 gigawatts (GW) of gas plants have recently been outputting only a few gigawatts on average because gas is unaffordable. Having more RE would help conserve fuel and increase energy security. On the other hand, India currently lacks meaningful storage for RE, and thus it is unsuitable for firm or dispatchable power. Therefore, RE can help improve energy security by providing additional and alternative sources of energy, but without proper energy storage options to address the challenge of variability, it will not solve the country's energy security concerns.

RE, excluding large hydropower, accounted for 76% of electricity generation capacity growth from FY 2017 to FY 2023.[9] However, this was made possible because between FY 2011 and FY 2016 coal-based capacity grew at more than double the growth rate of overall power demand (14.5% versus under 7%). This created temporary surplus capacity that ensured that evening peak demand could be met by coal, thereby addressing the current variability issues posed by RE and allowing more RE to be deployed (without more complex energy storage systems being installed).

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[7] Central Electricity Authority (India), "Executive Summary on Power Sector," August 2023, https://cea.nic.in/wp-content/uploads/executive/2023/08/Final_Executive_Summary_August_2023.pdf.

[8] India has had several "around-the-clock" bids for power using RE, but only a few of them have mandated storage. Most have relied on oversizing and blending different RE technologies, and also do not guarantee true around-the-clock power.

[9] If hydropower is counted as RE, which new government definitions allow, then RE was 79% of capacity growth in this time period. This percentage is calculated from Central Electricity Authority (India), *Growth of Electricity Sector in India from (1947–2023)* (New Delhi, September 2023).

Beyond coal, India's fossil fuel of choice is primarily petroleum, much of which is used for transportation. Natural gas accounts for a small percentage of the energy mix (nearly half of which is imported). Plans to increase the domestic production of oil or gas have not materialized as hoped. Some of this may simply be geology, but policies and incentives have not aligned with what the private sector needs to take exploration risk. Worldwide, many exploratory or wildcat wells are done by specialists who expect high rewards for high risks.[10]

Oil imports are an energy security concern and are a substantial drain on the Exchequer.[11] They were the single-largest component of India's total imports in FY 2022 and over a quarter of total commodity imports (adding crude oil plus petroleum product imports).[12] Alternatives to fossil fuels are thus desirable, but their economics are just one of several challenges that India faces in its energy transition. Technological feasibility is another challenge, especially outside the power sector. Long-distance aviation, for example, is unsuitable for batteries, and biofuels are viewed as the only option. But this then raises the specter of land limitations, a problem more acute in high-population developing countries like India. Green hydrogen is viewed as the solution for hard-to-abate industrial sectors, but it is both expensive and nascent in terms of commercialization and scaling.[13] It also requires enormous amounts of clean electricity to produce, putting it in competition with RE for grid resources and further adding to land pressures.

Jobs and a skilled labor force are other key factors for both the energy transition and energy security. India wants to increase manufacturing as a share of its economy under a flagship program called Make in India. The initiative was revamped after the Covid-19 pandemic to focus on a "self-reliant India," which includes extensive support for the production of clean energy technologies within the country. The objective is to avoid reliance on imports, especially from China, which has historically dominated the supply of solar PV cells and modules.

Energy Transition Plus Energy Security

Securing India's energy system requires a range of decisions and interrelated policies. The transition will involve the private sector, which seeks policy clarity, consistency, and coordination. India needs to figure out how to align top-down (central government) targets with bottom-up (state-level) actions. This is especially true in the electricity sector—a "concurrent" (dual jurisdiction) topic under the country's constitution, but where most problems are at the state level, such as the high financial losses by distribution companies, creating counter-party risk for RE developers.

If energy security is envisaged as energy "service" security, efficiency becomes an important (but underappreciated) priority. Ultra-efficient air conditioning, projected to be the largest driver for electricity growth in the coming years, will lower energy requirements, green or otherwise. Unfortunately, both efficiency and greening are disproportionately capital-intensive endeavors,

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[10] Peter Nichols and Rahul Tongia, "Exploring a Nation's Natural Wealth," *Mint*, October 10, 2018, https://www.livemint.com/Opinion/No5Ig2IMqCcrtBB4Cba26H/Opinion--Exploring-a-nations-natural-wealth.html.

[11] India was criticized over its imports of discounted Russian crude oil after sanctions, but some of the same entities bought Indian petroleum products refined in India from the same Russian crude. India is a net exporter of petroleum products.

[12] See Ministry of Petroleum and Natural Gas (India), *Indian Petroleum & Natural Gas Statistics 2021–22* (New Delhi, October 2022), https://mopng.gov.in/files/TableManagements/IPNG-2021-22_L.pdf. India imported $110 billion of crude oil. Total imports were about $610 billion, of which commodity imports were around $475 billion.

[13] Hydrogen can displace alternate fossil fuels for many applications, but it is not found in nature and must be manufactured. Today, most hydrogen is produced by steam reforming methane, which leads to significant CO_2 production. This is termed "gray hydrogen." "Green hydrogen" is when hydrogen is produced by electrolysis of water through electricity, and when the electricity comes from renewable energy, thus producing virtually no CO_2.

and recent increases in global interest rates are making energy investments even more difficult. India thus welcomes global financial support (where climate finance equals special finance, not just more debt).

Key questions and issues that India will need to address include the following:

- How does the country secure supply chains for clean energy technologies? Some raw minerals are unavailable in India, and it has also lagged behind its Asian peers in terms of processing the critical minerals required for the energy transition.
- To what extent will India be able to achieve its Make in India ambitions? Will this policy delay the growth of clean technology while domestic firms ramp up manufacturing capacity, or, alternatively, will mandates for domestic manufacturing raise the costs of clean energy (given that India has high costs of capital, logistics, and electricity prices for industrial users)?
- Does India have the financial wherewithal to institute massive industrial policy alignments similar to those in the U.S. Inflation Reduction Act? India has a range of incentive programs, such as production-linked incentives for manufacturing and renewable purchase obligations (RPOs) for clean energy, but the funds available are modest at best (and RPOs are effectively unfunded mandates, which is one reason they face headwinds).
- What financing will be available for the transition? If there is a premium for being green, how much premium can be borne for being secure? How can India de-risk the domestic financial ecosystem for private sector investment in climate and energy?
- Should India further invest in fossil fuels, and if so, how much and in which form? Critics believe that any fossil fuel investment locks India in to higher emissions, but the alternatives can expose it to greater need for imports, price volatility, and even energy insecurity.

In the power sector, recent surplus capacity from coal power plants is nearing exhaustion, and storage for RE is not anywhere near viability at scale—at least not without a high carbon price. And while India may move toward a carbon market or carbon price, this raises costs. If India does add more coal power plant capacity for a few more years, it should be state-of-the-art technology that is ultra-efficient and compatible with a high-RE grid.[14] It is unclear whether leapfrogging to RE can scale up fast enough, but some quarters view any new coal as untouchable. The global push to go green has translated into new norms for multilateral and development agencies that shun financing fossil fuels, even if they are greener and cleaner.

Conclusion: Energy Security and the Energy Transition Will Require Continuous Effort

India is working to be a global energy transition leader, including having used its G-20 presidency in 2022–23 to highlight issues of sustainability. However, its efforts are viewed by countries on an absolute scale instead of using relative measures, which is important to note in the context of North-South conversations on climate action and energy transition expectations. The OECD countries may ask for massive absolute reductions, but India's first efforts (through 2030) focus on relative improvements. Its 2070 pledge may appear insufficient to some, but India's plans

[14] India's specific coal consumption for power plants is over 630 grams of coal per kilowatt hour (kWh) of electricity, while China has a fleet-wide standard of 300 grams of coal per kWh. Even after adjusting for India's coal quality by a third, this implies significant scope for more efficient generation, something that would also lower local air pollution.

lead to lower future emissions per capita than in many high-emission countries pledging net zero by 2050. Thus, India is actually a leader, though it is unlikely to be viewed as such by many.

The ultimate challenge for India's energy security is the same as for its energy transition: scaling up fast enough. Having sufficient energy available at an accessible price is already challenging before adding in conditional factors like security and decarbonization. A few indicative numbers illustrate this challenge. Just to meet its 2030 targets for solar power, India needs to add around 28 GW of solar annually, but it has thus far only added 13–15 GW per year. This required growth ignores shortfalls in adding wind power, which lags even further behind its targets in relative terms. Together, its targets need to grow by around 40 GW per year. Further, to reach net-zero emissions by 2070, ongoing analysis by the Centre for Social and Economic Progress indicates that from 2030 to 2070 India would need to add 95–140 GW of solar capacity every year, excluding storage requirements or other green energy.[15]

The good news is that there is enormous scope for cost-effectively increasing variable RE in today's grid without massive overhauls or storage. RE is so cheap that even "surplus" RE with occasional curtailment is not a problem. The downside is that RE will not be enough to ensure energy security in the short term. Thus, India will need to make hard calls about how to meet growing demand by balancing the inherent trade-offs of cost, security, and the environment. For example, does India want more coal power above and beyond the roughly 42 GW of additional capacity already under construction?

The whole world is watching and waiting to see when India can end its use of coal. Plans to have India retire its coal through Just Energy Transition Partnerships appear premature based on experiences from countries like Indonesia and South Africa. Questions remain over which country is paying, in what form, and whether the country is ready to absorb the money across the larger ecosystem of workers and affected stakeholders. In addition, most plans for Just Energy Transition Partnerships or equivalent arrangements focus only on the costs of exiting the coal system and ignore the premium to be paid for required alternatives to coal.

Over the last decade or so, India has aggressively focused on energy security at different levels: adding enough power plant capacity to cease load-shedding, providing 100% household electrification, and enhancing its strategic petroleum reserve. The biggest shift in energy policy, other than long-term plans to achieve net-zero emissions by 2070, has been the dramatic move toward RE in the power sector. This will go a long way toward ensuring that use of coal, at least in the power sector, peaks in the coming decade. However, given the challenges in scaling up RE, coal remains India's backstop and still accounts for over half of total primary energy supply today and three-quarters of electricity.

Growth in demand for energy is inevitable, but making the growth clean will require access to the appropriate technologies and immense capital. This is something Western countries can help with. In fact, they are obligated to do so based on their pledge at the 2009 UN Climate Change Conference in Copenhagen (COP15) to provide $100 billion of climate financing to poorer countries. India can also be a strategic partner, especially in energy digitalization, information technology, and services. It should not be pushed to the back of the line every time there is a global energy crisis. The harder it is for India to get access to clean energy solutions or even affordable

[15] This number takes into consideration the advent of green hydrogen and the pervasive use of electric vehicles. The exact requirement would vary based on energy efficiency trends, GDP growth, the structure of the economy, and many other variables.

natural gas, the further behind the country will fall in reducing its use of coal, which fuels the majority of India's greenhouse gas emissions today.

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Realizing LNG's Potential to Meet Southeast Asia's Energy and Climate Goals

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EXECUTIVE SUMMARY

This essay examines the potential role of liquefied natural gas (LNG) in meeting Southeast Asian energy and climate goals and recommends collective and country-level policy actions to realize its full potential.

MAIN ARGUMENT

Southeast Asian countries are looking to decrease carbon emissions while meeting growing energy demand. The region is heavily reliant on coal, and LNG faces hurdles that will limit its role if not addressed. These include policymakers' perceptions of LNG as a scarce, price-volatile, and premium fuel source, as well as the need to invest significantly in infrastructure, develop stronger regulatory frameworks, and deploy greater use of carbon capture and storage (CCS) to support climate goals. Additionally, strong domestic constituencies and political transitions underway in key countries are increasing price sensitivity. As a result, LNG's role in Southeast Asia's energy mix is likely to remain important but limited in the absence of policy and market interventions. These will require ambitious, country-level policy initiatives and reforms, as well as international collaboration within ASEAN and with international partners, to address these challenges.

POLICY IMPLICATIONS

- Southeast Asia urgently needs reliable baseload alternatives to coal to reduce emissions, particularly in the power sector. Integrating more natural gas over coal is a clear pathway toward emission reductions given the current limitations of geothermal, hydropower, and battery storage and public concerns over nuclear safety.
- For LNG to play a more significant role in the regional energy mix, key stakeholders need to address concerns over affordability, geopolitical uncertainty, market volatility, and long-term investments in fossil fuel sources in the context of growing environmental and climate concerns. If these challenges are not addressed, LNG is currently poised to grow in volume, but it will not realize its full potential to displace coal and reduce emissions.
- Policymakers need to act collectively to provide greater confidence to investors in the future role of natural gas, including by providing stronger investment frameworks and market signals.
- Given that LNG infrastructure investments are made over horizons of 25–30 years and given the rapid pace of technological development in renewable energy resources, more widespread and cost-effective use of CCS is needed to ensure the viability of long-term investments.

Policymakers in Southeast Asia are seeking to chart paths toward energy and environmental security, which requires long-term planning to navigate an uncertain outlook for future energy markets, climate impacts, and geopolitical conditions. Decisions made about where to invest in energy infrastructure over the next five years will have consequential impacts on global carbon emissions goals and energy markets. Collectively, the ten members of the Association of Southeast Asian Nations (ASEAN) represent the world's fourth-largest energy consumer. The region is heavily reliant on fossil fuels, which make up around 83% of the current energy mix. Coal consumption has continued to rise at a rate of around 14% per year since 2018, according to the analytics company Kpler. Indonesia is the third-largest coal exporter in the world and relies on coal for over 60% of its electricity generation.[1] At the same time, domestic natural gas production is declining in some countries. According to the International Energy Agency (IEA), based on today's policies, the region will become a net natural gas importer by 2025, importing more than 130 billion cubic meters per year by 2050.[2]

While Southeast Asian countries are diverse in political systems, levels of economic development, size, energy resource endowments, and geography, there are cross-cutting climate and energy security concerns. A top consideration for policymakers is meeting energy demand trajectories to sustain economic growth and increases in the standard of living. By 2050, the region's population is projected to exceed 800 million people. Economic output is projected to grow rapidly over this period, with the IEA forecasting an average rate of 3.8% and the Institute of Energy Economics, Japan, forecasting a rate of 4.6%.[3]

Energy demand has risen in tandem with the region's economic progress. It has increased by 3% per year on average over the past two decades and is projected to rise at this rate through 2030, which will require more fossil fuel imports under current conditions. ASEAN is currently the world's largest coal market. While Southeast Asia is home to significant natural gas producers (Brunei, Indonesia, and Malaysia), liquefied natural gas (LNG) represents a relatively small percentage of the regional energy mix. In fact, the share of LNG has dropped over the past few years, leaving the region more reliant on coal. Given rising energy demand trajectories and LNG's favorable carbon footprint compared with coal, it is important to examine why LNG has underperformed relative to past projections of its role in the regional energy mix and potential commitment to carbon reduction goals.

This essay looks at policymakers' considerations when evaluating LNG's potential for contributing to energy security and climate imperatives, highlighting trends in key LNG-consuming and LNG-producing Southeast Asian countries. It then concludes with an assessment of the policy implications and potential pathways for regional and country-level collaborations and frameworks to maximize the potential benefits of LNG playing a greater role in the regional energy mix.

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[1] Gavin Maguire, "South East Asia Set to Enter Coal Importer Big Leagues," Reuters, May 11, 2023, https://www.reuters.com/markets/asia/south-east-asia-set-enter-coal-importer-big-leagues-2023-05-11.

[2] International Energy Agency (IEA), "Southeast Asia Energy Outlook 2022: Key Findings," May 2022, https://www.iea.org/reports/southeast-asia-energy-outlook-2022/key-findings.

[3] IEA, "Decarbonisation Pathways for Southeast Asia," April 2023, https://www.iea.org/reports/decarbonisation-pathways-for-southeast-asia.

Evaluating LNG as an Option

To meet rising energy demand, policymakers face complex choices. Given the timeline and cost of necessary infrastructure investments, these choices require planning decades into the future in an era of rapid technological and geopolitical change. Such long-term planning for the energy sector is particularly challenging for countries with high economic and population growth, which might have more limited resources and compressed timelines.

Adding to this complexity, ASEAN members have made ambitious carbon reduction commitments. Eight of ten countries have pledged to reach net zero by 2050, and Indonesia has pledged to do so by 2060. The Philippines is the one ASEAN member that has yet to commit to a net-zero pledge. According to a recent statement from the Philippine Department of Energy, the country's new energy policy will not include a net-zero commitment but will focus on dramatically increasing renewable energy usage. Regional climate and environmental commitments reflect not only international pressure but also, importantly, growing awareness among the public in many countries that Southeast Asia is one of the regions most vulnerable to climate change. Factors that increase its vulnerability include rising sea levels, heatwaves, floods, droughts, and unprecedented weather events, which threaten key agricultural zones, including in the Mekong subregion.

These climate considerations and commitments could cut both ways for LNG. On the one hand, according to the U.S. Energy Administration, natural gas emits almost 50% less CO_2 than coal.[4] This means that LNG can play a significant role in supporting ASEAN members' net-zero and carbon reduction commitments as they transition to cleaner fuels. On the other hand, rising concerns about climate change have led to greater scrutiny of long-term fossil fuel investments by financial institutions and the public, negatively affecting consideration of LNG. LNG terminals alone require investments of hundreds of millions to billions of dollars over long-term time horizons. Reportedly, some financial institutions are concerned that money put into oil and gas projects would be stranded capital.[5] In turn, some industry leaders have expressed frustration about the lack of financing and investment in carbon capture and storage (CCS) and other carbon reduction technologies to make these projects viable over the long term in the context of climate commitments, as the standard operational lifetime of new gas infrastructure can be 30 years or longer.[6]

Arguably, economic considerations often take top priority in the eyes of policymakers as they devise how to best meet energy demand and climate commitments. LNG is an expensive fuel source, and governments pushing for full post-pandemic recovery must address the global impacts of slowing growth in China and Russia's war in Ukraine. Another factor is that many governments, notably in Indonesia, Cambodia, Malaysia, and Thailand, are operating in environments of political transition or high political contestation. Such conditions elevate sensitivity over the short-term economic and political trade-offs of clean energy transitions, including loss of revenue, job losses, and any potential disruption to energy supplies, and further complicate already tough

[4] U.S. Energy Information Agency, "Electric Power Sector CO_2 Emissions Drop as Generation Mix Shifts from Coal to Natural Gas," June 9, 2021, https://www.eia.gov/todayinenergy/detail.php?id=48296.

[5] Shotaro Tani and Rurika Imahashi, "Asia Faces Billions in Stranded Assets If Gas Becomes Energy Pariah," *Nikkei Asia*, February 6, 2022, https://asia.nikkei.com/Business/Markets/Commodities/Asia-faces-billions-in-stranded-assets-if-gas-becomes-energy-pariah.

[6] IEA, "Outlooks for Gas Markets and Investment," April 2023, https://iea.blob.core.windows.net/assets/5cce10d6-6c88-4813-a40f-ceffecdb0986/Outlooksforgasmarketsandinvestment.pdf.

decisions. Moreover, in Myanmar political instability has curtailed most international investment in its energy infrastructure.

The deterioration of U.S.-China relations and the rising threat of conflict in the South China Sea or Taiwan Strait also factor into consideration of regional energy supply chains to an increasing degree. The Russia-Ukraine war brought concerns over LNG market volatility to the fore, as prices spiked in the aftermath of Russia's invasion and supplies became scarce. In Southeast Asia, energy price hikes caused by the war contributed to an increase in inflation rates across the region from 2% in 2021 to 5.1% in 2022.[7]

Higher LNG prices demonstrably suppressed Asia's LNG consumption, which is now projected to increase from 252 million tons in 2022 to 260 million tons in 2023 but is still lower than the 272 million tons in 2021.[8] Additionally, some countries, such as Vietnam and the Philippines, which are new entrants to the LNG market and smaller consumers, have faced challenges in securing long-term supply contracts. Concerns remain over the availability of supply due to reliance on the spot market. Countries also continue to be concerned about price volatility. Some market analysts are forecasting that demand could outpace supply by around 2030, and this threat of a long-term rise in prices will further slow investments, exacerbating potential shortages.[9] The diversion of LNG supplies to Europe, significant price spikes, and general uncertainty have dragged on policymakers' risk perception of LNG. Vietnam, for example, announced that it would redouble efforts to develop domestic supplies and renewable energy, while Pakistan canceled plans for new LNG-fired power plants.[10]

Declining domestic gas production in Southeast Asia and LNG market volatility have renewed policymakers' attention on developing regional gas production. However, only 9% of the world's proven gas reserves are in Asia, and weak regulatory frameworks and inadequate financing have challenged the sector's development of its full potential.[11]

Country Outlooks

Indonesia's policy frameworks and choices are crucial for achieving regional energy transition targets. As the fourth most populous country in the world, Indonesia aims to be the fourth-largest economy by 2050. President Joko Widodo (Jokowi), who must step down in 2024 due to term limits, views this as central to his legacy. The country is also the sixth-largest LNG exporter in the world and an important regional supplier. While Indonesia's coal consumption continues to grow, the government is moving to convert some diesel power to gas under the Just Energy Transition Partnership. Coordinating minister for maritime security and investment, Luhut Panjaitan, is preparing recommendations for Jokowi to limit Indonesian natural gas exports in the future

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8 Erwida Maulia, "LNG 'Inequality' Bites as Europe Takes Supply from Asia," *Nikkei Asia*, June 27, 2023, https://asia.nikkei.com/Business/Energy/LNG-inequality-bites-as-Europe-takes-supply-from-Asia.

9 Nishant Ugal, "World Needs $4.9 Trillion Oil and Gas Investments by 2030 to Prevent Shortfall: IEF," Upstream, February 16, 2023, https://www.upstreamonline.com/production/world-needs-4-9-trillion-oil-and-gas-investments-by-2030-to-prevent-shortfall-ief/2-1-1404971; and Yuji Nitta and Yuichi Shiga, "Vietnam, Philippines Heat Up LNG Demand in Southeast Asia," *Nikkei Asia*, July 14, 2023, https://asia.nikkei.com/Business/Energy/Vietnam-Philippines-heat-up-LNG-demand-in-Southeast-Asia.

10 Eric Yep, "Vietnam's New Energy Masterplan Focuses on Energy Security, Coal and Gas Production," S&P Global, August 4, 2023, https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/lng/080423-factbox-vietnams-new-energy-masterplan-focuses-on-energy-security-coal-and-gas-production.

11 Asia Natural Gas and Energy Association, https://angeassociation.com.

to supply the domestic market in support of carbon reduction goals. Half of Indonesia's current LNG export contracts will expire in 2030, which is equal to around half of domestic production. The government has said that by 2050 all Indonesian natural gas production will be for domestic consumption to fulfill the country's plans to increase gas consumption from 22.4% of the energy mix in 2025 to 24% in 2050. Currently, coal constitutes 43% of the total energy mix and 62.5% of the energy mix in the power sector.[12]

Long-time LNG importers in Southeast Asia include Singapore, Malaysia, and Thailand, which began importing LNG more than a decade ago. In Singapore, imported gas meets 96% of electricity generation needs.[13] Like Indonesia, Malaysia is an important LNG exporter for the broader region. In 2020, natural gas accounted for approximately 42% of Malaysia's energy mix, crude oil and petroleum 27%, and coal 26%. The government recently increased its renewable energy target to 70% by 2050.[14] Thailand relies on natural gas for around two-thirds of its power generation capacity and is increasingly reliant on LNG imports due to declining domestic production. The country's LNG imports reached a high in 2022, coinciding with price spikes and leading to public outcry over electricity prices.[15] This subsequently became an issue in the May 2023 elections. In response, state-owned oil and gas enterprise PTT has pledged to double domestic production at the Erawan field and to increase production by 10% at the Bongkot field next year after a decrease in production caused domestic electricity prices to spike in 2022.[16] The government has also committed to rapidly developing renewable energy resources to boost its energy security in the face of rising import dependence for fossil fuels and, in particular, unpredictable LNG prices.

In the Philippines, declining domestic production of natural gas, namely in the Malampaya gas field, has led the country to make a significant commitment to building LNG infrastructure. The Philippines received its first LNG imports in June 2023 in Batangas for a gas-fired power station, and seven new LNG projects are underway. While some analysts have praised the Philippines for not turning toward more coal consumption, others have criticized the high price of LNG, given that electricity prices in the country are already among the highest in Southeast Asia.

Vietnam's Eighth National Development Power Plan pledges to phase out coal power. To this end, the country plans to quadruple its gas-processing capacity by 2030, transforming it into a significant consumer of LNG. In July 2023, Vietnam received its first LNG imports at the Thi Vai LNG terminal in the south. It plans to increase LNG capacity from one million to three million tons and to build a second LNG terminal in Binh Thuan Province. Hanoi aims for LNG to account for around 15% of its power generation capacity by 2030, up from zero currently.[17] However, LNG

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12 Kelik Dewanto and Mecca Yumna, "Natural Gas Deemed Important in Bridging Energy Transition," Antara, November 21, 2022, https://en.antaranews.com/news/261397/natural-gas-deemed-important-in-bridging-energy-transition; and Hans Nicholas Jong, "Indonesia's Coal Burning Reaches Record High amid Rise of Industrial Smelting," Mongabay, July 3, 2023, https://news.mongabay.com/2023/07/indonesias-coal-burning-hits-record-high-and-green-nickel-is-largely-why.

13 "Singapore—an Energy Snapshot," Asia Natural Gas and Energy Association, https://angeassociation.com/singapore-gas-policy-brief.

14 Kresentia Madina, "Looking into Malaysia's Energy Transition Progress," Green Network Asia, October 9, 2023, https://greennetwork.asia/news/looking-into-malaysias-energy-transition-progress; and "Malaysia Sets New Target to Reach 70% of Renewables in the Power Mix by 2050," Enerdata, May 12, 2023, https://www.enerdata.net/publications/daily-energy-news/malaysia-sets-new-target-reach-70-renewables-power-mix-2050.html.

15 Emily Chow and Isabel Kua, "Thailand to Rely on Coal for Power Longer amid Record Gas Prices," Reuters, October 26, 2022, https://www.reuters.com/article/asia-energy-thailand-electricity/thailand-to-rely-on-coal-for-power-longer-amid-record-gas-prices-idUSL4N31R0VZ; and Stephen Stapczynski and Ann Koh, "Thailand at Risk of Fuel Crunch with Imported Gas Too Pricey," Bloomberg, June 21, 2022, https://www.bloomberg.com/news/articles/2022-06-22/thailand-at-risk-of-fuel-shortages-with-imported-gas-too-pricey.

16 Anuchit Nguyen, "Thailand to Boost Gas Production in Bid to Avoid New Price Shock," Bloomberg, August 14, 2023, https://www.bloomberg.com/news/articles/2023-08-15/thailand-to-boost-gas-production-in-bid-to-avoid-new-price-shock#xj4y7vzkg.

17 Francesco Guarascio, Emily Chow, and Khanh Vu, "Vietnam's Big Bet on LNG May Not Ease Its Power Crisis," Reuters, July 17, 2023, https://www.reuters.com/business/energy/vietnams-big-bet-lng-may-not-ease-its-power-crisis-2023-07-16.

price spikes in 2022 have led the government to prioritize domestic gas production, including in geopolitically sensitive areas contested with China.

Policy Implications

Regional Solutions

To maximize the energy security and climate benefits of LNG, policymakers need to have a higher degree of confidence in market and price stability, particularly in low- and middle-income countries. The diversion of natural gas to Europe at the onset of the Ukraine crisis was particularly concerning to new market entrants and smaller importers, such as the Philippines and Vietnam, that lack the market power of China, Japan, and South Korea. ASEAN members could take the following steps to improve these conditions by acting collectively:

- Exploring collective bargaining on long-term LNG contracts to reduce the supply volatility that the region experienced when LNG cargo was diverted to Europe after Russia's invasion.
- Continuing to promote geopolitical stability and seek the peaceful resolution of overlapping claims that are potential obstacles to new gas production sites.
- Negotiating an ASEAN leaders' statement to instill confidence in investors by designating gas as a sustainable fuel source and encouraging more investment in upstream and midstream infrastructure.
- Supporting transitional financing for large infrastructure projects and the deployment of CCS and other carbon reduction technologies.
- Continuing to strengthen regional actions through the ASEAN Ministers on Energy Meeting and further developing regional strategies for complementary energy infrastructure development and, where possible, interlinked domestic policies.
- Reaffirming high-level political commitments to carbon reduction goals and launching necessary energy sector reforms, including phasing out fossil fuel subsidies, which favor coal's lower price point.
- Working collectively to develop regulatory frameworks and improve the business environment to reduce investor risk and support the buildout of LNG infrastructure and new natural gas production.

Opportunities for ASEAN-U.S. Collaboration

The United States is an important economic and security partner for Southeast Asia and is the world's largest natural gas producer. As such, it can play a key role in helping the region maximize the benefits of natural gas and develop CCS technologies to enable long-term use. Potential areas for cooperation include the following:

- Promoting technology innovation and knowledge sharing, including in developing best practices on policy and regulatory approaches and supporting the provision of capital to finance clean energy transitions.
- Implementing the Just Energy Transition Partnership that was recently launched with Indonesia and Vietnam and expanding the program to more countries across the region.

- Engaging with ASEAN on standards for certified natural gas, which would establish third-party criteria for certifying which supplies have been produced responsibly according to high environmental standards.
- Continuing collaboration with ASEAN through the U.S. Agency for International Development and engagement with both the private sector and member governments.
- Increasing cooperation with Japan in supporting ASEAN clean energy transitions. In May 2021, Japan's Ministry of Economy, Trade and Industry announced the Asia Energy Transition Initiative, which includes a variety of support for the realization of pragmatic energy transitions in Asia. The initiative provides $10 billion in financial support for renewable energy, energy efficiency, LNG, and CCS.

Conclusion

In Southeast Asia, LNG is on a growth trajectory due to rising demand for power and ongoing efforts to meet decarbonization goals. Despite this momentum, however, LNG is unlikely to reach its full potential to displace coal so long as it is viewed as a premium and risky fuel source. Policymakers interested in fully realizing the potential of LNG to meet energy demand and reduce emissions should work closely with industry leaders to devise strong regulatory frameworks, attract investment in infrastructure, and encourage the further development and deployment of CCS.

International partners also have important roles to play. The costs of transitioning to clean energy are significant. The IEA estimates that Southeast Asia needs annual investments of $190 billion to reach its 2030 climate goals.[18] Indonesia estimates that $200 billion per year is required for its clean energy transition alone through the next decade and $1 trillion annually after that to meet its target of net zero by 2060.[19] Malaysian prime minister Anwar Ibrahim recently said that Malaysia needs $375 billion to meet its 2050 net-zero commitment.[20] These numbers are daunting. While ASEAN economies must take all measures to reduce carbon emissions, developed economies must play a role in supporting affordable financing and technological deployment for the region to meet its energy and environmental security goals.

[18] IEA, "Southeast Asia Energy Outlook 2022: Key Findings."

[19] Shotaro Tani, "Indonesia Needs $200bn a Year until 2030 for Net-Zero Emissions," *Nikkei Asia*, October 20, 2021, https://asia.nikkei.com/Spotlight/Environment/Climate-Change/Indonesia-needs-200bn-a-year-until-2030-for-net-zero-emissions.

[20] Mei Mei Chu, "Malaysia Needs to Invest $375 Bln in Renewables to Reach 2050 Climate Goals—Report," Reuters, March 9, 2023, https://www.reuters.com/business/energy/malaysia-needs-invest-375-bln-renewables-reach-2050-climate-goals-report-2023-03-09.

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