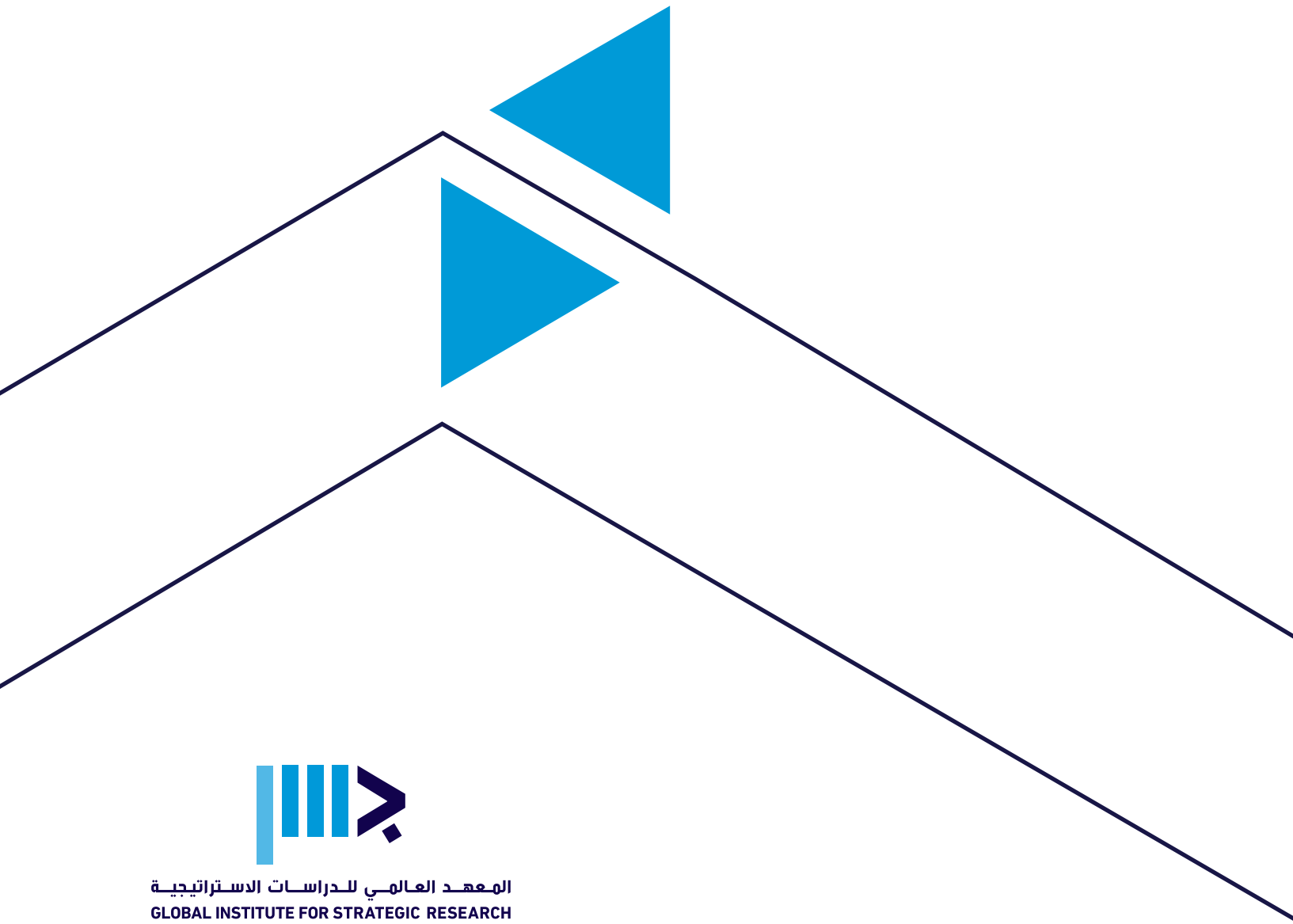
QATAR'S LNG BETWEEN THE UKRAINE WAR AND RENEWABLE

Prospects and Challenges



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Prospects and Challenges

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Table of Contents

EXECUTIVE SUMMARY

Qatar witnessed a momentous year in 2022, with the successful organization of the FIFA World Cup. Additionally, the gas price surge caused by the Russian invasion of Ukraine resulted in Qatar attaining its highest financial revenues since 2014. As the largest exporter of LNG globally, Qatar's geopolitical position was bolstered and increased its influence in the global energy landscape.

The war in Ukraine has impacted global energy security and has highlighted the importance of diversifying energy supplies and investing in LNG infrastructure to ensure energy security. This led to a strategic shift in energy policies and investments toward LNG. As European countries sought additional LNG volumes, increased competition drove up prices and price volatility in the global LNG market. Meanwhile, the energy crisis also prompted countries such as Japan and South Korea to rethink their plans to phase out nuclear power as sentiment shifts in favor of reliable and renewable energy supplies and increasing focus on energy security. Also, Asia stands out as a region where the demand for natural gas remains steadfast and resilient. It boasts the most significant potential for additional coal-to-gas switching, and the expected robust economic growth is anticipated to drive an increased need for cleaner energy sources.

Notably, Qatar has an advantaged strategic location from which it can swing supplies between the Atlantic and Pacific basins. In addition, it offers relatively low emission intensity, which will further help it strengthen its market presence among environmentally mindful consumers seeking LNG deals. One of the many challenges for the LNG industry is the growing global focus on decarbonization, net-zero carbon emissions, and significant investment in renewable energy. Despite this, Qatar is well-positioned to maintain its leading spot as one of the world's top LNG producers and exporters on account of its large reserves of natural gas, well-established and integrated LNG production infrastructure and supply chain, considerable technical and operational expertise, low-cost production base, deep relationships with established buyers, access to shipping lanes, and the ability to provide reliable and flexible supply to customers around the world. The emergence of QE Trading will help ensure that Qatari LNG profits from its low cost of production and broader market access across both long-term contracts and spot basis pricing.

LNG is expected to maintain a positive outlook, driven by factors such as the shift from coal and oil to gas, the emergence of more efficient carbon capture technologies for power production, and its use in specialized transportation sectors. However, LNG is increasingly challenged on environmental grounds, given its more limited emission reduction potential compared with other low-carbon energies. To ensure that gas plays more than a transitional role in the global energy mix, it is imperative to prioritize the transition of gas supply toward greener alternatives. In the broader economy, Qatar is investing substantially in various solar power initiatives, such as solar desalination plants, solar-powered manufacturing facilities, and large-scale solar power plants.

In this scenario, Qatar must improve its technological edge, market dynamics and cost-effectiveness, operational efficiency, and supply chain resilience. It should develop strategic contingency plans for

various market scenarios, including supply disruptions, geopolitical changes, and shifts in energy trends and demand.

Key Messages:

- Qatar was the world's largest liquefied natural gas (LNG) exporter in 2022, supplying 79.04 million tons (mt) or approximately 106.76 billion cubic meters (bcm) of natural gas, and accounting for over 20% of global LNG exports.

- Over 85% of Qatar's natural gas exports were LNG, and more than 72% were shipped to Asia. China was Qatar's largest market, followed by India, South Korea, and Pakistan. Together, these four countries accounted for approximately 54% of Qatar's total exports of LNG in 2022.

- Qatar is also upping its LNG bet as it will increase the country's production capacity from the current 77 mt/y to 142 mt/y (approximately 193.12 bcm) by 2027.

- Russia's invasion of Ukraine has proven to be a highly disruptive event for the global LNG market but has conversely enhanced Qatar's economic and geopolitical importance. The shortages experienced by the European Union (EU) due to the need to replace Russian pipeline gas have significantly impacted the global price, which has benefited Qatar state revenues. For this reason, Qatar is now navigating a profoundly new era in the energy market.

- The trend toward stronger ties between Qatar and China has grown, highlighted by China's emergence as Qatar's primary LNG buyer in 2022. As Qatar and China have recently signed numerous new LNG contracts, Qatar is set to overtake Australia as China's largest supplier by 2026, fostering greater interdependence between the two countries in decades ahead.

- Nevertheless, Qatar faces increasing competition from other LNG producers, as a wave of new supply (mainly from the US) set to come on stream in the mid-2020s could tip the market into a sustained surplus. These emerging trends could put downward pressure on pricing and long-term oil-index contracts, which will translate to hitting Qatar's primary source of revenue. However, this must be weighed against worldwide endeavors to reduce carbon emissions, which could potentially decrease the overall demand for fossil fuels.

- Based on Qatar's North Field expansion, Qatar's challenge is finding new buyers for its significant volumes coming on stream between 2024 and 2027. It is recognized that this is a risk facing the country as global supply could outpace demand. It is noted that this poses the challenge of leading to a depressed global price for LNG, thereby hitting Qatar's state revenues.

- Despite these emerging challenges, Qatar is well-positioned to maintain its leading role as one of the world's top LNG producers and exporters. In this context, the study proposes several policy recommendations that could benefit energy decision-makers in Qatar.

Main Recommendations:

- The challenge confronting Qatar's LNG industry due to competition from the United States could be mitigated by upholding a competitive edge. This essentially means boosting investments in innovative technologies and research and development (R&D) to reduce overall costs within the LNG production chain. This strategy will enable Qatar to vie based on pricing, giving it greater financial flexibility in signing new gas contracts.

- Qatar has employed a new trading unit for its LNG, and the potential exists for it to enhance this further through creative marketing techniques. It is envisaged that this will allow Qatar to secure more LNG sales and purchase agreements. Furthermore, it may grant Qatar increased flexibility in the spot markets and enable the country to navigate unexpected occurrences, be it geopolitical or natural disasters.

- Qatar should increase its efforts to reduce carbon emissions by addressing methane leaks and embracing technologies like carbon capture, solar energy, and utilizing LNG for its ships' fleet to enhance Qatar's environmental appeal. By reducing emissions throughout its production process, Qatar can strengthen its market presence among environmentally mindful consumers seeking LNG deals.

- While hydrogen (blue or green) and carbon capture and storage (CCS) might not take the forefront over the current decade, it would be prudent for QatarEnergy to initiate the contemplation and cultivation of these concepts. Such considerations could carry substantial implications for the company down the line.

- Although Qatar recognizes that the primary demand is concentrated in East and South Asia (and to some extent in the Middle East), the challenges faced by European countries concerning Russia contribute to its attractiveness as a market. Hence, Qatar must strategically frame its foreign policy as a means of harmonizing between these geopolitical regions, thereby maximizing its global significance and influence.

- The energy transition will further contribute to the challenges associated with changing patterns in the workforce, particularly in securing talented personnel for oil and gas companies. In response, Qatar should adopt digitalization, automation, and enhancing the local workforce tech skills as strategies to mitigate labor market challenges and increase operational efficiency.

- Qatar should develop contingency plans for various market scenarios, including supply disruptions, geopolitical changes, and shifts in demand. Being prepared for different outcomes can help mitigate risks.

1. Introduction

Qatar had a momentous year in 2022, with the successful organization of the FIFA World Cup cementing its position on the global sports stage. Additionally, the gas price surge caused by the conflict in Ukraine resulted in Qatar attaining its highest financial revenues since 2014. As the largest exporter of liquefied natural gas (LNG) globally, Qatar's geopolitical significance has grown for both the East and West.

Qatar was the world's largest LNG exporter in 2022, supplying 106.76 billion cubic meters of natural gas (79.04 million tons) and accounting for more than 20% of the global LNG supply[1] (see Table 1). Net LNG imports reached 389.2 mt (529.31 bcm), representing a 4.5% growth, compared with 372 mt (505.92 bcm) imported in 2021. The total degasification capacity reached 1,068 mt/y (1452.48 bcm), with nine new degasification terminals coming on stream in 2022.[2]

Table 1: The World's Top Five LNG Exporters in 2022

	2022 (mt/y* (~bcm)	Global share (%) 2022
Qatar	79.04 (106.76 bcm)	20.3
Australia	78.50 (102.59 bcm)	20.2
US	75.44 (102.59 bcm)	19.4
Russia	32.07 (44.47 bcm)	8.2
Malaysia	27.60 (37.54 bcm)	7.1
World total	389.19 (529.29 bcm)	100.0

Note:** 1 million tons LNG = 1.360 BCM. ***Source: GIIGNL 2023 Annual Report. https://giignl.org/giignl-releases-2023-annual-report/

Over 85% of Qatar's natural gas exports were LNG, and more than 72% were shipped to Asia.[3] Helped by rising global demand among tight supply, Qatar has seen its LNG exports jump more than four times in the last two decades.[4] China was Qatar's largest market, followed by India, South Korea, and Pakistan. Together, these four countries accounted for approximately 54% of Qatar's total exports of LNG in 2022.

Table 2: Qatar's 5 Largest LNG Export Destinations (by Country, 2022)

Country	Mt* (~ bcm)
China	15.98 (21.73 bcm)
India	10.54 (14.33 bcm)
South Korea	9.98 (13.57 bcm)
Pakistan	6.10 (8.29 bcm)
UK	5.63 (7.65 bcm)
Asia	57 (77.52 bcm)
Europe	18.72 (25.45 bcm)
Total exports	79.04 (107.49 bcm)

Source: GIIGNL 2023 Annual Report. https://giignl.org/giignl-releases-2023-annual-report/

Qatar is also upping its LNG bet as it will increase the country's LNG exports. The North Field Expansion, comprising North Field South (NFS) and North Field East (NFE), is expected to increase Qatar's LNG production capacity from the current 77 million tons per year (mt/y) to 126 mt/y by 2027.[5] Such a figure will hit 142 mt/y (around 193.12 bcm) if we consider the commercial partnership (around 18 million tons of LNG per year) between Qatar and ExxonMobil in the United States (US).[6]

Yet Russia's invasion of Ukraine has also shown how energy security and decarbonization are intertwined. While LNG will fare better than coal and oil, commodity growth could suffer significant setbacks due to the growing competition from renewables and nuclear power in the long term. In addition, a wave of new LNG exports (see Figure 1) is set to come online in the next few years. These emerging trends could put downward pressure on pricing and long-term oil-index contracts, thereby impacting Qatar's primary source of revenue.

Such a situation could have repercussions for Qatar's LNG strategy, particularly since Doha is on the verge of expanding its production by the equivalent of nearly two-thirds of its current capacity in the next four years, and Doha urgently needs to sign these new LNG quantities with long-term contracts.

The paper encompasses four primary sections. Initially, it highlights the shifting dynamics within LNG markets, and how the war in Ukraine has altered the outlook of the LNG industry. The subsequent section will identify the short-term impact and its immediate consequences on Qatar, specifically regarding the LNG market. The third section will focus on the emerging challenges and obstacles Qatar's gas strategy may encounter in the medium to long term. Finally, this paper explores the options for Doha to mitigate the challenges that have transpired in the global LNG markets.

2. The LNG Market: A New Landscape

The war in Ukraine has impacted global energy security and fundamentally changed the outlook of the LNG industry. Although the full extent of the impact is difficult to quantify, the war has highlighted the importance of diversifying energy supplies and investing in LNG infrastructure to ensure energy security.

This situation highlights the complex interplay between geopolitical events, energy security concerns, and the evolving dynamics of the global LNG industry. However, it is worth noting that the geopolitical landscape and energy dynamics constantly evolve, and the market response to such events can be complex and multifaceted.

- **Supply Disruptions**: The outbreak of war in Ukraine in February 2022 led to disruptions in natural gas supplies from Russia, the top natural gas supplier to Europe at that time. Most European countries seek alternative sources of natural gas, including liquefied natural gas (LNG). This has increased the demand for LNG in Europe.

The war in Ukraine transformed Europe's role from being the "market of last resort" for LNG sellers to becoming the prime market for the global LNG industry. The European Union's (EU's) strategy to reduce dependence on Russian gas has increased its demand for LNG, bringing European buyers into competition with Asian countries in spot markets and temporarily forcing LNG prices beyond the means of low-income developing countries such as India, Pakistan, and Bangladesh.[7] Yet, this shift also added to the growing importance of countries like the United States and Qatar.

The EU and UK buyers imported 121 mt (164.56 bcm) of LNG in 2022, a 60% increase from 2021.[8] Meanwhile, demand in the Asia Pacific region was lower than expected and registered an 8% decline. China's imports were down by almost 21% to 63.8 mt (86.76 bcm), the highest annual decrease since the start of LNG imports in 2006, falling back below Japan (72.0 mt or 97.92 bcm, down 3%) as the world's top importer in the process.[9]

- **Changing Price Dynamics:** As European countries sought additional LNG volumes, increased competition drove up prices in the global LNG market. Concerns about potential disruptions to LNG shipments due to the war in Ukraine further contributed to price volatility. For example, European gas prices surged to more than ten times their average level in 2022, reaching almost $600 a barrel in oil terms, but have since fallen sharply;[10] however, fluctuations in prices are still ongoing.

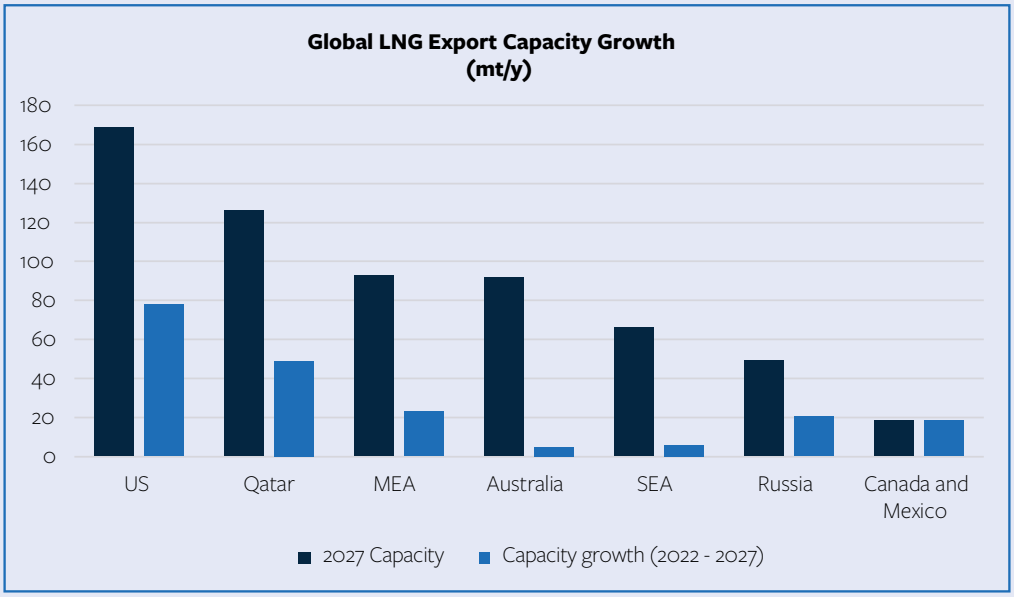
The value of global LNG trade doubled in 2022 to an all-time high of $450 billion.[11] Meanwhile, geopolitical uncertainty and tightening supply also drove oil prices to their highest level since 2013. This placed upward pressure on oil-indexed LNG contract prices, which jumped by 70% in 2022.[12] This situation certainly reflected positively on Qatar's export earnings.

- **LNG Infrastructure Investments:** The conflict in Ukraine has also led to increased investment in LNG infrastructure in Europe as countries look to build more import terminals and storage facilities to increase their access to LNG supplies. In addition, some project developers reassessed their plans and considered alternative locations for LNG export terminals, focusing on more stable, friendly, or politically secure regions. This situation allowed Qatar to invest more in such new infrastructure and become more active in European markets (see Table 12).

- **New LNG Trade Routes:** The war in Ukraine also accelerated the exploration of alternative LNG trade routes. European countries sought to establish direct LNG supply agreements with top exporters such as the United States and Qatar. This resulted in the opening of new LNG trade routes and increased flexibility in the global LNG market.

The US has emerged as one of the top three LNG exporting countries. Qatar was the largest LNG supplier in 2022, followed by Australia and the US.[13] The US and Qatar are projected to contribute the most to the increase in LNG supplies, while an expected decline in Australian LNG outflows is expected beyond 2030. Restrictions on Russia due to the sweeping sanctions are anticipated to curtail their ambitions to more than double their LNG exports at the end of this decade (see Figure 1).[14]

Figure 1: Global LNG Export Capacity Growth



Note: Capacity includes BNEF's top picks for the final investment decision in 2023, assumes no decommissioning, and a total capacity of Artic 2. MEA is the Middle East and Africa. SEA is Southeast Asia. ***Source:*** BloombergNEF (BNEF), https://tinyurl.com/282vmb3r

- **Geopolitical Considerations:** The war in Ukraine has brought attention to the geopolitical risks associated with energy dependence. Indeed, the war highlighted the vulnerability of relying heavily on a single transit route in one country for energy supplies. As a response, governments sought to reduce their exposure by diversifying their energy sources, including increasing LNG imports. This led to a strategic shift in energy policies and investments toward LNG.

This issue is reflected in how Chinese and European companies diversify their import sources. As per Zhang Yaoyu, the global head of LNG trading at PCI (PetroChina International), "Supply security is still at the heart of our business activities. Trading capability is one of the enablers ... to help us better deal with market swings."[15] thus creating more LNG opportunities for sales for QatarEnergy.

- **Larger Spot Markets:** European buyers concerned about supply disruptions turned to spot market purchases to meet their immediate demand. This increased activity in the spot market influenced LNG pricing dynamics. According to the International Energy Agency (IEA), the cost of Europe's LNG imports will more than triple in 2022 to approximately $190 billion. Some estimates put Europe to share more than a third of global LNG spot market trades in 2022, from around 13% in 2021.[16] QatarEnergy has established a fresh trading unit dedicated to its LNG marketing operations. Given the expansion of the global spot market, this division has the potential to hold a significant role for the company shortly.

Overall, these shifts in the LNG markets directly impacted Qatar and are anticipated to carry implications in the times ahead. This impact became evident (as illustrated in the subsequent part of the paper) through a significant rise in Qatar's export revenues, notably in 2022. Nevertheless, these changes are predicted to pose fresh challenges for Doha over the medium and long term.

3. Qatar: Positive Short-Term Impact

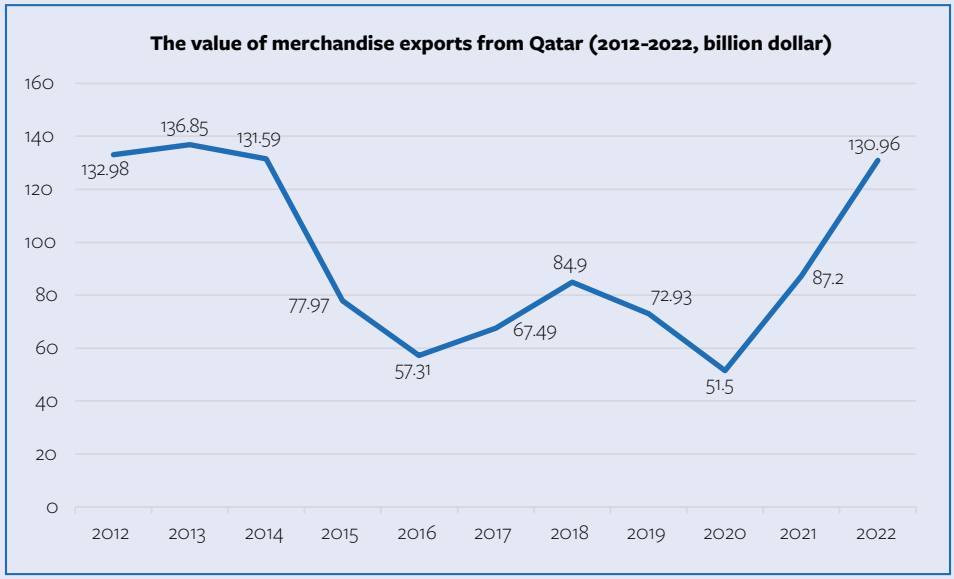
The evolving dynamics of the LNG market and the geopolitical landscape continue to shape Qatar's role as a leading LNG exporter. The extent of the impact on Qatar depends on numerous factors, including Qatar's strategic decisions, market dynamics, geopolitical developments, and evolving global energy trends.

As the current situation stands, Qatar has capitalized on geopolitical advantages, experienced substantial financial profits, and enhanced its market presence in China and to some extent in Europe. These gains have been attributed to the ongoing conflict in Ukraine, the surge in global LNG prices in 2022, and a growing global inclination to diversify import sources while prioritizing energy security.

• The Economic Gains

Qatar's export revenues hit a 9-year high of almost $131 billion by 2022[17] on record LNG prices and export volumes well over its nameplate capacity.[18] This growth translates to a remarkable increase of nearly $44 billion or 50% of goods exports for 2022, as opposed to more than $87 billion recorded in 2021.[19] Qatar was able to maximize its spot sales in 2022 by maxing out its LNG facilities, as some well-known institutions put Qatar's LNG exports higher than the figure in Table 1. Figures from data intelligence firm *Kpler* show that Qatar exported a record 80.23 mt in 2022 versus a nominal 77 mt/y capacity, [20] while the *Energy Institute* said that number jumped to 114.1 bcm (~83.86 mt).

Figure 2: Qatari Export Revenues



Source: ITC, https://tinyurl.com/2s3t5mpc

Despite budgeting for a $2.3 bn deficit, Qatar achieved a high budget surplus of $24.5 bn for 2022, the biggest since $29.8 bn for 2014-15.[21] Underlining Doha's economic positive momentum, the credit rating agency *Moody's* (November 2022) upgraded Qatar's outlook from stable to positive while maintaining its Aa3 sovereign rating, the fourth highest.[22] *Fitch Ratings* also revised (March 2023) the outlook on Qatar's Long-Term Foreign-Currency Issuer Default Rating (IDR) from Stable to Positive and affirmed the IDR at 'AA-.'[23]

Doha also changed its market share strategy and now asks for long-term oil-linked contract prices above 12.5%. Between 2020 and early 2021, the prices of these types of contracts fell into the 10% range (slope),[24] levels not seen in the last ten years.[25] For example, the 27-year QatarEnergy (QE)-China Petrochemical Corporation (Sinopec) deal, which will start in 2026, is rumored to have a slope above 12.75% with limited flexibility.[26]

However, with global energy prices declining, Qatar's fiscal surplus will narrow in 2023 but remain well above historical averages.[27] In 2022, the country reported a 10.3% of GDP fiscal surplus, and in 2023, there is a broader expectation that the fiscal surplus will narrow to around 7 to 9% of GDP due to lower hydrocarbon revenues. This remains substantially wider than the 3.6% of GDP pre-pandemic ten-year average.[28]

Nevertheless, Qatar is likely to post robust trade surpluses over the coming years.[29] *Fitch Ratings* noted in a recent report: "The end of 2022 Football World Cup outlays, less spending on large projects, and restrained current spending trends will allow Qatar to maintain budget surpluses until 2025, despite lower hydrocarbon prices".[30]

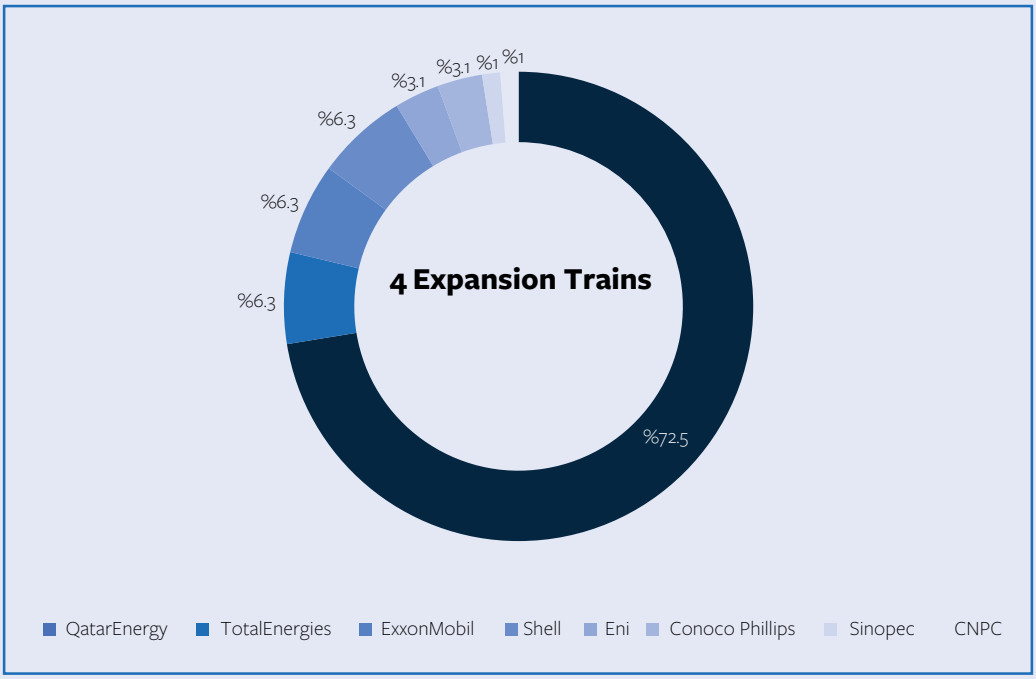
Strategic Benefits

Geopolitics can also present opportunities for Qatar's LNG industry, as the conflict in Ukraine highlighted the importance of energy security and diversification of gas supply sources for European countries. Qatar emerged as a reliable and attractive LNG supplier with abundant natural gas reserves and an established LNG infrastructure. This strengthened Qatar's geopolitical position and increased its influence in the global energy landscape.

The war in Ukraine may have prompted Qatar to engage in energy diplomacy, leveraging its LNG resources and market position to enhance its geopolitical influence. By providing energy security to Europe, Qatar will benefit from increased gas export revenues and stronger defense cooperation with the West, notably the United States. The US "*Al-Udeid*" airbase on the peninsula is being expanded, and President Biden designated Qatar in March 2022 as a " Major non-NATO ally," a status that includes military and financial benefits.[31]

Qatar has also engaged in joint ventures or partnerships with other international energy companies to leverage its combined resources and market access, enabling it to expand its LNG presence and mitigate potential geopolitical risks. The fact that big Western [or Chinese, Sinopec, and CNPC] energy companies (including deals with the UK's Shell, ExxonMobil, and ConocoPhillips of the US, France's TotalEnergies, and Italy's Eni) were so keen to join Qatar's LNG expansion project affirms Qatar's growing importance as an LNG "superpower" (see Figure 3).[32]

Figure 3: QatarEnergy's NFE Share Drops to 72.5% Following the Addition of China's Sinopec and CNPC



Source: Qatar Energy, MEES, https://tinyurl.com/mv6k8a34

Notably, a significant share of Qatar's financial surpluses is directed to the Qatar Investment Authority (QIA) or Qatar's sovereign wealth fund. Although the bulk of QIA investments are commercially motivated and it is used to diversify sources of income for the Qatari government, the economic power of QIA gives Doha a "soft power" to be reckoned with. This soft power-oriented approach was visible in the grand spectacle of Qatar hosting the 2022 FIFA World Cup. In August 2023, the QIA had an estimated $475 billion of assets under management, ranking it tenth globally.[33]

• China's Growing Importance

The conflict in Ukraine and factors like geopolitical rivalry and concerns about energy security may have prompted China to seek a broader range of LNG suppliers. This shift might have benefited Qatar by allowing it to expand its market presence in China. Currently, Mainland China is the primary purchaser of Qatari LNG, and it is anticipated that the country's demand for natural gas will continue to rise in the foreseeable future. This growth in demand presents a significant market for Qatar's LNG exports. In 2021, China surpassed all other nations to become the largest market for Qatari exports, and in 2022, it climbed to the top spot as the leading importer of Qatari LNG. It is also noteworthy that Beijing has now become Doha's principal trading partner (see Table 3).

Table 3: Qatar's Top 5 Export Destinations (2022)

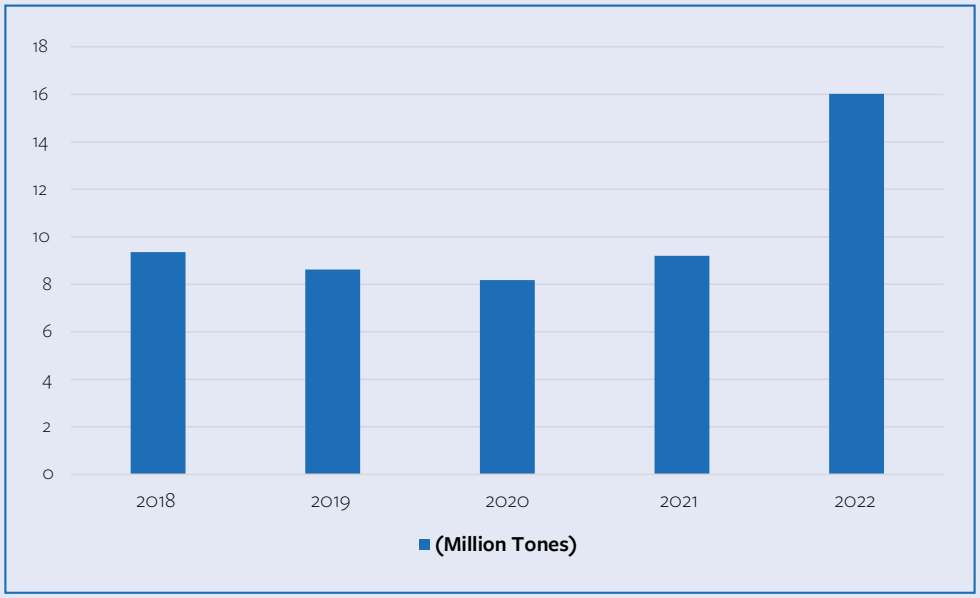
	2022 ($ mn)	% of the total (~)
China	20,782.20	15.9
India	15,148.18	11.6
South Korea	14,278.70	10.9
Japan	12,570.09	9.6
UK	8,556.73	6.5
World	130,920.80	100

Source: IMF, https://tinyurl.com/3kwsxx7v

Mainland China imported 110.25 mt (150 bcm) of natural gas in 2022, of which LNG accounted for almost 58%.[34] After becoming the world's largest LNG importer in 2021, China's LNG imports slipped to 63.44 mt (~86.28 bcm) in 2022, a decrease of nearly 19.5% from 79 mt (107.44 bcm) in 2021, pushing it down to world's No. 2 LNG importer behind Japan.[35] A steep decline in LNG imports is attributable to weaker-than-expected demand and high spot prices in 2022.

Meanwhile, Australia remains China's number one supplier for 2022 despite a 30% fall to 22.02 mt (~29.95 bcm). However, imports from Qatar, up 73% to a record 15.73 mt (21.39 bcm)[36], massively closed the gap[37] and made China the largest importer of Qatari LNG. This follows the beginning of 2022 deliveries of two contracts that Qatar inked with China: 3.5 mt/y (4.08 bcm) for China National Offshore Oil Corporation (CNOOC) and 2 mt/y (2.72 bcm) to China Petroleum & Chemical Corporation (Sinopec).[38]

Figure 4: Chinese Imports of Qatari LNG



Source: Kpler, Energy Intelligence: https://tinyurl.com/3nzwzkh3

The growing importance of Qatar's energy ties with Mainland China has also been reflected in several new long-term supply deals. In November 2022 QatarEnergy signed a $60 billion long-term Sale and Purchase Agreement (SPA) to supply Sinopec with 4 mt (5.44 bcm) of LNG a year from the start-up of the new capacity expansion in 2026.[39] According to Saad Al-Kaabi, Minister of Energy in Qatar and the President and CEO of QatarEnergy, the deal "marks the longest gas supply agreement in the history of the LNG industry (...) it would further solidify the excellent bilateral relations between China and Qatar and help meet China's growing energy needs."[40]

The agreement will last 27 years, making it China's most extended LNG supply agreement and the first supply contract for volumes from Qatar's 32 mt/y North Field East (NFE) expansion.[41] China's Sinopec also booked a 1.25% stake in NFE development, making it the first Chinese and Asian player to secure a stake in the scheme dominated by Western majors.[42] Seven months later, the China National Petroleum Corporation (CNPC) and QatarEnergy signed a second deal identical to the one sealed with China's Sinopec last November (4 mt of LNG a year for 27 years from the start-up of the new capacity expansion in 2026, a 1.25% stake in NFE development).[43]
Both agreements put China ahead of other countries (at the end of August 2023) in securing gas supplies from Qatar's North Field expansion.[44] QatarEnergy has signed eleven LNG Sale and Purchase Agreements (SPAs) with China's state-owned and private companies, of which three contracts are expected to start in 2024 and 2026.[45] As a result, Qatar is set to overtake Australia as China's largest supplier by 2026.[46] Saad Al-Kaabi recently told the Qatari newspaper *Gulf Times* that China is now Qatar's top buyer of LNG; "China is the largest consumer of LNG from Qatar by far (...) China is our number one customer. China is also the world's biggest buyer. China is also a huge market for LPG, helium, and condensates, of which Qatar is the world's top producer."[47]

Table 4: Long-term Contracts Between China and Qatar

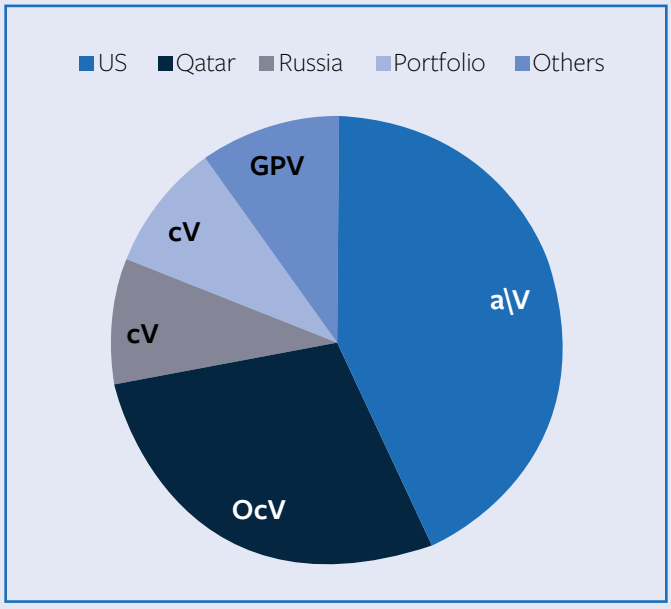
Export Country	Buyer	ACQ (MT/Y)	Start date	End date
Qatar	CNOOC	3.5 (4.76 bcm)	2022	2036
	Sinopec	2 (2.72 bcm)	2022	2032
	Suntien Green (S&T International)	1 (1.36 bcm)	2022	2037
	PetroChina	3.4 (4.62 bcm)	2018	2040
	CNOOC	2 (2.72 bcm)	2011	2035
	PetroChina	3 (4.08 bcm)	2011	2036
	Sinopec	4 (5.44 bcm)	2026	2053
	CNPC[48]	4 (5.44 bcm)	2026	2053

Source: GIIGNL 2023 Annual Report, https://giignl.org/giignl-releases-2023-annual-report/

In the long term, Qatar-China volumes are likely to rise further, particularly with Beijing's tendencies to diversify import sources and the desire of Chinese companies to reduce their exposure to the spot market and other players (see Figure 5). Esteemed international firms forecast that China's LNG imports will climb to 100 mt/y (136 bcm) by the end of this decade if all new contracts come into force.[49] China would also need another 80 mt/y (108.8 bcm) of new LNG to meet its forecast demand within the next two

decades, which will likely exceed 120 mt/y (163.2 bcm).[50] Meanwhile, China is witnessing a boom in LNG infrastructure with import demand surges as three terminals have come online (so far) in 2023, bringing annual import capacity to 120 mt (163.2 bcm).[51]

Figure 5: Chinese LNG Sales and Purchase Agreements Signed in 2021-2022 by Country (%)



Source: Oxford Institute for Energy Studies (OIES), https://rb.gy/lp3eh

Against this strategic backdrop, Qatar's LNG industry faces challenges that could impact its future growth (see the next section). These challenges will require ongoing investment, technological adjustment, and adopting new policies to ensure that the country remains a leading player in the global LNG market.

4. Qatar's LNG Industry: Emerging Challenges

Qatar, as the world's largest LNG exporter, expects to face competition on multiple fronts. The primary economic challenge for the country would be a decline in gas prices, given Doha's heavy dependence on LNG exports.[52] Qatar also has a relatively small domestic natural gas market, meaning that most of its LNG production is exported to international markets. This reliance (see Table 13) on energy exports can make the country vulnerable to changes in global LNG fundamentals.

The LNG market faces significant uncertainty, with projections showing a tight market and relatively elevated prices in the short term, but doubts persist over long-term growth. Qatar faces increasing competition from other LNG producers, as a wave of new supply (particularly those in the United States) set to come on stream in the mid-2020s could tip the market into a sustained surplus (see Figure 2). This competition could affect Qatar's ability to maintain its market share and pricing power in the global LNG market.[53]

Meanwhile, buyers need clarification on the role of LNG in the decarbonization era and how to best position themselves for the transition to lower-carbon fuels.[54] The LNG industry has also been scrutinized recently because of concerns about its environmental impact related to greenhouse gas emissions.[55] However, during their communique at the May 2023 gathering, the heads of the Group of Seven (G7) urged the adoption of LNG investment to enhance energy security. Nonetheless, they categorized this as a "temporary" step as part of their efforts to reduce reliance on Russian energy.[56]

• Competition: The US New Wave

Qatar is set to expand its LNG production by an additional 49 mt/y (66.64 bcm) by 2027. There is a massive 33 mt/y (44.88 bcm) North Field East (NFE) expansion, with Qatar's next phase, 16 mt/y (21.76 bcm) North Field South (NFS) expansion, also targeting start-up from 2027. One of the critical challenges Qatar could face in European and Asian markets would be the competition from US-based LNG exporters, which benefit from relatively low-cost shale gas feedstocks and have established markets to a certain extent.[57]

Meanwhile, the United States has emerged as a significant player in the global LNG industry in recent years, thanks to the development of shale gas reserves and the construction of new LNG export facilities. The US began exporting LNG in February 2016, ending that year with only 3.56 mt (4.84 bcm) of exports. Since exports rose rapidly, reaching 76.52 mt (104.1 bcm) in 2022, making the US the third largest LNG exporter in the world behind Qatar and Australia.[58]

The US is already set to become the world's largest exporter of LNG in 2023 – but it will not stop there.[59] *BloombergNEF* forecasts that the US will double its gas liquefaction capacity over five years. The country's annual LNG export capacity is expected to reach 169 mt (229.84 bcm) by 2027, placing it far ahead of Qatar.[60] *Wood Mackenzie* noted in a recent report that at least 16 new LNG projects are planned (under construction and pre-FID projects) on the US Gulf Coast, which could add 70-190 mt/y (95.2 bcm to 258.4 bcm) of capacity by 2030. Nevertheless, analysts expect that many of these projects will not materialize as the race to build them in time intensifies and financing for long-term hydrocarbon projects in a decarbonizing world becomes harder to secure.[61]

Table 5: US LNG Projects in the Works

Project	Operator	Status	Capacity (mn t/y)	Earliest start-up
NFE Louisiana FLNG	New Fortress Energy	Under Construction	2.8	2024
Plaquemines LNG Phase 1	Venture Global	Under Construction	13.33	2024
Golden Pass LNG	QatarEnergy/ExxonMobil	Under Construction	18.09	2024
Corpus Christi Stage 3	Cheniere	Under Construction	10.43	2025
Plaquemines LNG Phase 2	Venture Global	Under Construction	6.67	2026
Port Arthur LNG Phase 1	Sempra Infrastructure	Under Construction	13.5	2027

Source: Wood Mackenzie, https://tinyurl.com/ycds7hhr

Qatar and the US offer completely different pricing formulas. The first key difference is how LNG is priced, as Qatar bases its traditional oil-linked contracts on a coefficient of oil prices known as a "slope." In contrast, US LNG deals adopt a cost-plus formula linked to the US gas benchmark Henry Hub.[62] The other key difference between the US and Qatar is the flexibility buyers have to resell their shipments. US deals are destination-free, or buyers of US LNG could resell the cargo if they see fit, while Qatar still insists on destination clauses prohibiting resale.

For Doha, this strategy helps optimize its huge shipping fleet and prevents Qatari volumes from competing in the open market.[63] However, hub indexation on US LNG will compete with oil-linked Qatari contracts in Europe and Asia. Importantly, such a strategy (oil-index deals) has been under fire in the past by major buyers such as the EU and Japan. If forecasts about the global LNG trade glut after the mid-2020s turned out to be correct or close to projections, such restrictions in Qatar's contracts could again raise red flags with anti-competition regulators in countries such as Japan and Europe.

Table 6: Key Differences Between Contracts Signed With Qatar and a US Greenfield Project Developer

	Qatar	US
Price Index	Oil linked, such as Brent or Japan Crude Cocktail	US Henry Hub
Delivery Terms	Delivered ex ship (DES)	Free On Board (FOB)
Contract Duration	15-27 years*	20 years†
Start Date	2026 (Phase 1 North Field East)	2026-28
Minimum Annual Contract Quantity	At least one mt/y	NA
If the Buyer Opts Not to Take a Cargo	Subject to the take-or-pay provision	Pay a fixed liquefaction fee
Shipping Length to Japan	15-20 days	30-35 days

*Based on recent contracts signed with ConocoPhillips and Sinopec for NFE offtake †Existing US exporters can offer shorter contracts of 13-15 years. A take-or-pay provision requires the buyer to take and pay for a quantity of LNG in a contract year, or otherwise pay an agreed price for any LNG not taken. ***Source:*** Energy Intelligence, https://tinyurl.com/yc6s54fs

• Rise of Renewables

Another challenge for the LNG industry is the growing global focus on decarbonization and significant investment in renewable energy. Daniel Yergin, the well-known American energy expert, and vice chairman of *S&P Global*, put it: "The global disruptions in energy markets and the war in Ukraine have added impetus to the push for renewable energy and the drive toward net-zero carbon emissions."[64]

Within this framework, the prospective growth of natural gas, encompassing LNG as well, will depend to some extent on the pace at which decarbonization or energy transition occurs. There are increased efforts to accelerate renewable development across many regions or countries, such as China, the US, Europe, Japan, and India, to support their long-term plans to move away from fossil fuels. The *Economist Intelligence Unit* forecasts that renewable energy consumption will grow at an annual average rate of 10% during the next decade.[65] However, these predictions are still subject to the level of real investment in renewable energy, geopolitical shifts, and most notably unexpected natural disasters that could transform into unforeseen events.

Mainland China is the world's largest market for renewable energy investment. The US will see the second-highest growth in the renewables sector with support from the recently enacted Inflation Reduction Act (IRA), which contains $369 bn in climate spending to support domestic clean energy manufacturing and renewables development[66] in addition to the EU's REPowerEU, Japan's Green Transformation Plan, and the growth of renewables in India and beyond.[67]

Global investment in the low-carbon energy transition totaled $1.1 trillion in 2022 – a new record and considerable acceleration from the previous year.[68] Fatih Birol, the executive director of the International

Energy Agency (IEA), optimistically wrote recently in the *Financial Times* that "with a peak in fossil fuel demand visible for the first time and set to happen before the end of the 2020s (…) the energy world is changing fast — and clean technologies are building momentum."[69]

While the shift toward renewable energy is undeniably a tangible process with promising outcomes across various regions and industries, certain factors may impede the pace of this transformation. The power competition (between the US and China) on clean energy and protectionist policies risks getting in the way of scaling up green technology manufacturing.[70] Investment in clean energy is also falling far below the required levels. The IEA recently warned that green investments must rise even faster to $4 trillion annually by 2030 if the zero net targets are to be met.[71]

Higher interest rates will also increase the cost of financing renewable energy projects, slowing down the pace of energy transition.[72] The IEA also acknowledges that there will be inherent challenges as wind and solar power contribute significantly to the world's electricity. It further highlights that the reliance on electricity is increasingly influenced by weather conditions, as evidenced by recent heatwaves, storms, droughts, and [freezing conditions].[73]

Meanwhile, the energy crisis also prompts countries such as Japan and South Korea to rethink their plans to phase out nuclear power as sentiment shifts in favor of reliable energy supplies and increasing focus on energy security.[74] Japan and South Korea, key legacy markets, and significant LNG consumers also seek to reduce their dependence on fossil fuels in favor of renewables and meet their greenhouse gas emissions reduction targets.

Japan, the world's top LNG importer in 2022, is trying to raise the share of nuclear power in its energy mix while scaling back the consumption of hydrocarbons. Last December (2022), Japan approved a draft low-carbon energy policy that could allow existing nuclear reactors to operate for more than 60 years. It also includes plans to build new reactors to replace decommissioned ones.[75]

Similarly, in South Korea, the government has set ambitious targets for expanding the use of renewable energy, such as wind and solar power, and is exploring the possibility of using nuclear power as a source of clean energy. In October 2021, the Korean government finalized its roadmap to reach carbon neutrality by 2050, which indicates intentions to shift the energy mix away from pollutive coal and reduce the current excessive dependence on LNG through investments in renewables and hydrogen.[76]

Table 7: Japan and South Korea's Forecast LNG Demand

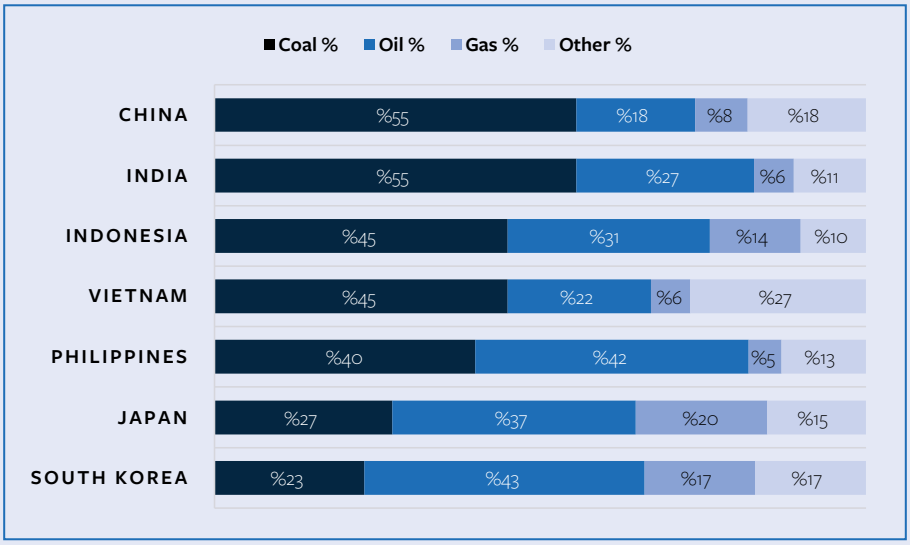
(MT)*	2023	2024	2025	2030
Energy Intelligence's R&A				
Japan	69.9	68.5	68.4	67.5
South Korea	46.7	45.9	46.5	48.3
Fitch Solutions				
Japan	70.4	71.1	71.7	67.1
South Korea	43.6	44.2	44.6	41.6

* **Note:** One million ton = 1.360 bcm. ***Source:*** Energy Intelligence Research & Advisory, Rystad Energy, https://tinyurl.com/3ez95xpz & BMI Research: South Korea Oil & Gas Report. (2023). South Korea Oil & Gas Report, Q4, 1-72, (33) & BMI Research: Japan Oil & Gas Report. (2023). Japan Oil & Gas Report, Q4, 1-66, (32).

With that being said, the resilience of gas demand differs significantly across diverse markets and sectors. While demand in some industrial markets (like Europe, Japan, and South Korea) is projected to decrease in the coming years, other regions, notably the Middle East and North Africa (MENA), display a much more vigorous and lasting demand outlook over the next few decades.[77]

Meanwhile, the Asia region (mainly China, India, and most countries in South and Southeast Asia) stands out as a region where the demand for natural gas remains steadfast and resilient. It boasts the most significant potential for additional coal-to-gas switching, and the expected robust economic growth is expected to drive an increased need for cleaner energy sources.[78] The region is poised to retain its attractiveness as a global gas and LNG import hub, with exporters eyeing Asia as a crucial market to meet demand.

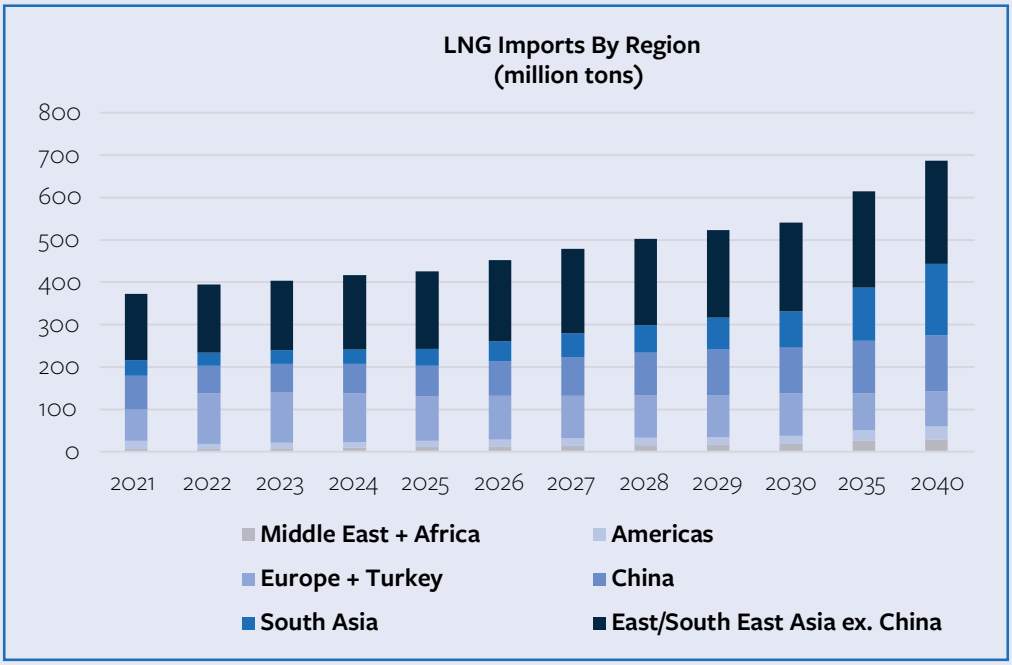
Figure 6: Primary Energy Use by Fuel Type (Selected Asian Countries, 2022)



Note: Percentages may not add up to 100 because of rounding.
Source: Energy Institute, Statistical Review of World Energy, https://www.energyinst.org/statistical-review

The continued growth of LNG demand in other Asian countries/regions, such as China, India, and Southeast Asia (see Figure 7), is projected to offset any potential decline in demand from Japan and South Korea. India is anticipated to experience the second-largest surge in LNG imports globally in the coming decade. Over ten years until 2032, India's LNG imports are projected to more than double, showing a remarkable increase of nearly 29 mt/y (40 bcm).[79] This volume growth is unparalleled in any market except for Mainland China, where LNG imports are expected to expand by more than 51.45 mt/y (70 bcm).[80]

Figure 7: LNG Imports by Region (mt, 2021-2040)



Source: Energy Intelligence Gas and LNG Research, https://tinyurl.com/yc5hxku9

For Qatar, the shift in the importance of the significant Asian LNG markets has already begun to take shape. In 2022, one of the main changes in trade flows was a reshuffle in Qatar's customer base. In 2021, its four largest buyers by volume were South Korea, India, China, and Japan; in 2022, its top buyers were China, India, and South Korea, with Japan falling behind significantly (see Table 2).[81] China emerged as the largest off taker of Qatari LNG in 2022, with an increase of almost 70%, and Qatar's exports to India also rose by around 10%.[82]

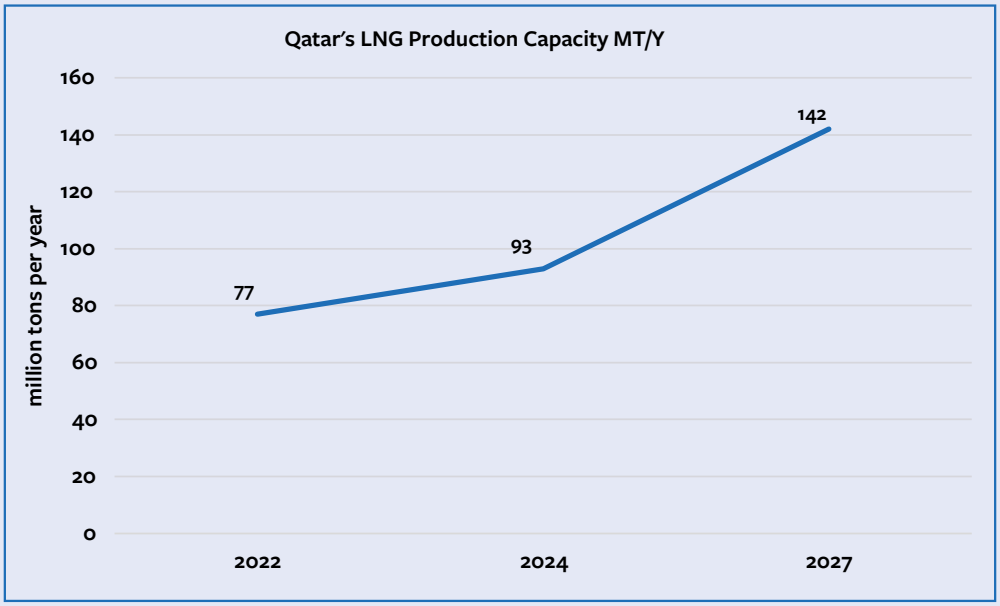
• Pursuing New Contracts

In February 2021, Qatar Petroleum (currently QE)[83] made the final investment decision (FID) on the North Field East project. The project will be composed of 4 mega LNG trains and will have a total capacity of 33 mt/y (44.88 bcm), and the new capacity is expected to be commissioned in the next three years.[84]

QE also aims to complement its North Field East expansion with the 16 mt/y (21.76 bcm) North Field South project, taking the total capacity from 110 mt/y (149 bcm) to 126 mt/y (171.36 bcm) by 2027.[85] QE

(70%) and ExxonMobil (30%) are also developing a US 16 mt/y Golden Pass LNG export facility, with an anticipated start-up in 2024.[86] This means that QE's new production of LNG will hit 65 mt/y (88.4 bcm) between 2024 and 2027, bringing Qatar's total output to 142 mt/y (193.12 bcm) (see Figure 8).

Figure 8: Qatar's LNG Expansion



Source: QatarEnergy 2022 Sustainability Report, https://tinyurl.com/33wyj8nn

Qatar exports 85-90% of its LNG under oil-indexed, long-term sale and purchase agreements (SPAs), mainly delivered ex ship (DES) to Asian buyers on owned or long-term chartered vessels.[87] However, it is a different story, with Qatar's new LNG volumes coming online between 2024 and 2027. As things stand today (end-August 2023), unsigned volume accounts for almost 82% of Qatari LNG's new production capacity in Qatar and the United States, or over 37% of Qatari LNG's total production capacity (in Qatar and the US) expected to come online by 2027.

Up until now (end-August 2023), Qatar has entered into four agreements for the supply of LNG, amounting to 11.8 mt/y (~16.01 bcm), with purchasers in China, Bangladesh, and Germany. Additionally, Qatar is currently engaged in advanced negotiations with India's GAIL and Thailand's state energy company, PTT (PTT.BK).[88] Furthermore, Qatari contracts totaling more than 21.5 million tons are scheduled to expire between 2023 and 2027[89] (see Tables 8 & 9).

Table 8: QatarEnergy's North Field LNG Supply Deals

Company	Country	Contract Length	Vol. (million tons/yr)	First Delivery
ConocoPhillips	Germany	15 years	2	2026
Sinopec	China	27 years	4	N/A
CNPC	China	27 years	4	N/A
PetroBangla	Bangladesh	15 years	1.8	2026

Source: Energy Intelligence, https://tinyurl.com/3sv636ek (as of August 2023)

Should this scenario continue until 2024 and beyond and QatarEnergy not succeed in securing additional new contracts for its new capacity (or most of it), Qatar could be tempted to offer competitive prices or more lenient terms that will get buyers lining up to sign new contracts.[90] Or the country will sit on the most significant amount of unsold LNG in the market over the next few years.[91] Doha's success rate in signing contracts between now and then will determine the future depth of the spot market and the upcoming competition. More uncontracted Qatari LNG will result in a deeper spot market and more direct competition between QatarEnergy and US producers.[92]

Consequently, with the growth in more market-based LNG, the strength of the relationship between international natural gas prices and oil prices could be eroded,[93] and gas indexation to oil prices may decrease over time. For Qatar, dependence on hydrocarbons (see Table 13) leaves fiscal and external dynamics vulnerable to shifts in global energy prices.[94] Qatar's gas pricing strategy could be impacted if renewables demand rises faster than LNG or, as several forecasts expect, the LNG market might be heading toward a period of oversupply after the middle of the current decade.[95]

However, Qatar's Minister of State for Energy Affairs and CEO of QE, Saad Al-Kaabi, is optimistic that sufficient progress is being made. Al-Kaabi signaled that additional supply agreements with Asian customers are in the pipeline; he expected more supply deals with Europe to be signed after the summer of 2023.[96] Al-Kaabi also told the Qatar Economic Forum in June 2023, "We have other deals we are working on. There is the potential that we will run out of all of the gas from the NFE and NFS by the end of the year as far as long-term contracts are concerned."[97] Even he told the *Financial Times* the same month, "We are going to have several European deals before the end of the year – for sure, 100%."[98]

5. Qatar's Mitigation Options

Despite these challenges, Qatar is well-positioned to maintain its leading spot as one of the world's top LNG producers and exporters. These advantages include its large reserves of natural gas, well-established and integrated LNG production infrastructure and supply chain, considerable technical and operational expertise, low-cost production base, deep relationships with established buyers, access to shipping lanes, and the ability to provide reliable and flexible supply to customers around the world.

Qatar is also betting that it can outcompete other prospective suppliers through its partnerships with the major Western IOCs (TotalEnergies, Shell, ExxonMobil, ConocoPhillips, Eni) and Chinese companies, all of which have interests in Qatar's North Field expansion.[99] Notably, it has an advantaged strategic location from which it can swing supplies between the Atlantic and Pacific basins. In addition, it offers relatively low emission intensity, which will further help it gain ground as climate change concerns rise higher on the agenda for international buyers.[100]

To maintain its LNG export lead over crucial competitors such as the US and even Australia, QE seeks to domestically reduce costs and expand its global footprint by acquiring stakes in exploration acreage across different basins and through joint ventures (JVs) with international oil companies.[101] QE's restructuring program has involved the takeover of its foreign investment arm Qatar Petroleum International, divesting non-energy units and imposing stricter conditions on foreign partners. It is active in all energy chain segments and participates in significant oil and gas developments.[102]

• Innovative Marketing Strategy

QE may first seek to extend volumes of expiring contracts with its legacy buyers, such as Japan and Korea, as there is still a reluctance to renew some of the old agreements due to the new bet on investments in renewable and nuclear energies, in addition to significant exposure to the spot market.

Japanese buyers decided not to renew contracts representing 7.2 mt/y (9.79 bcm), which expired in 2021. In 2022, Japan imported 2.9 mt of Qatari LNG, a significant drop from 9 mt imported in 2021 (12.24 bcm).[103] However, there seem to be ongoing negotiations between the two parties, and there is an opportunity to sign new contracts, considering the recent trip of the Japanese Prime Minister to Qatar in July 2023.[104]

Meanwhile, Australia, Japan's largest LNG supplier, introduced reforms to tighten emissions standards at its LNG plants and prioritize gas supplies for the domestic market.[105] Australia's latest policy changes regarding LNG supply have raised concerns in Japan about the country's ability to remain a dependable and stable long-term LNG supplier.[106] The most recent updates concerning the strike at Australia's major LNG production facilities have also intensified concerns about the country's supply availability.[107]

In 2022, Australia's share of Japanese LNG imports increased to 42.7% from the previous year's 35.8%, mainly attributed to the expiration of long-term LNG contracts between Japanese companies and Qatar in 2021. As a result, Qatar's share of Japanese LNG imports decreased to 4.0% in 2022, down from 12.1% in 2021. However, Australia's recent development and policy shifts might compel Japanese buyers to explore alternative LNG providers, opening up possibilities for Qatar to engage in new contractual arrangements.

Qatar's second largest market is India, which imported a record 10.67 mt from the country in 2022, despite total imports dropping sharply during high gas prices.[108] By December 2023, India's Petronet must extend its 25-year contract with Qatar for an annual supply of 8.5 million tons. However, increased competition from China and Europe has prompted Qatar to raise its term rates. Consequently, the price-sensitive Indian market finds it more expensive to engage in such contracts, leading to the inability of Indian firms to secure term deals recently.[109] Thus, QatarEnergy must find a suitable formula that pleases both parties while preserving its dominant position in this promising market.

South Korea's exposure to the spot LNG market has been increasing, highlighted by spot LNG imports rising from 10.5 mt/y (14.28 bcm) in 2021 to 16.3 mt/y (22.17 bcm) in 2022, representing 35% of total LNG imports.[110] Therefore, Qatar still has room to pursue new LNG deals. Since 2018, there has been a noticeable downward trend in Qatari supplies to South Korea, and a significant 4.92 mt/y agreement with the state LNG importer KOGAS is scheduled to expire by the end of 2024.[111] While a new two-mt/y deal between the parties is set to start on January 1, 2025, it covers less than half of the volumes from the expiring contract.[112]

Table 9: Qatar's Contracts Expire 2023-2028

Export country	Buyer	ACQ (MT/Y)*	End date
Qatar	Petronas	1.1	2023
	Centrica	2	2023
	RWE Supply and Trading	1.1	2024
	OMV	1.1	2024
	KOGAS	4.92	2024
	Endesa	0.75	2025
	KOGAS	2.1	2026
	EDF Trading	3.4	2027
	ENI	2.05	2027
	Kansai Electric	0.5	2027
	Petronet LNG	5	2028
	Petronet LNG	2.5	2028
	GAIL, IOCL, BPCL and GSPC	1	2028

* **Note:** One million ton = 1.360 bcm. ***Source:*** GIIGNL 2023 Annual Report, https://giignl.org/giignl-releases-2023-annual-report/

Meanwhile, there are approximately 12 mt/y (16.32 bcm) with European utilities, which may be interested in a ten or 15-year extension to face the current deficit due to their decarbonization strategy and uncertain gas demand.[113] Qatar is also optimistic that in the medium term, Asian demand for LNG is expected to rebound. *BP Global's* latest energy outlook forecasts that demand for natural gas in China, India, and other emerging Asian countries (Qatar's significant markets) will continue to grow in the coming years as these countries switch away from coal and, outside of China, continue to industrialize.[114]

As mentioned earlier, the Qatari Energy Minister has signaled on more than one occasion that Asian and European countries will sign more contracts. However, the Qataris will not leave things to chance. Upon completion of the North Field expansion, QE will oversee the marketing of approximately 142 mt/y (193.12 bcm) of LNG, 126 mt/y (171.36 bcm) from domestic plants, and its 16 mt/y (21.76 bcm) equity Golden Pass volumes in the US. QE aims to manage the bulk of these supplies via its new centralized marketing arm.

QE Trading LLC, a wholly owned subsidiary of QE established in 2020, "establishes a world-class, dedicated LNG trading arm for QE. Based in Qatar's capital Doha, QE Trading is tasked with building a globally diversified third-party and equity LNG portfolio. QE Trading's activities include physical trading and origination, derivatives trading, freight trading, portfolio optimization, and trading risk management."[115]
The emergence of QE Trading will help ensure that Qatari LNG remains best positioned to profit from its low cost of production and broader market access across both long-term contracts and spot basis pricing.[116] This is also part of a wider strategy to compete better with prominent portfolio players such as BP and Shell plc, which reportedly have a combined LNG portfolio of 100 mt or roughly 25% of the global market.[117]

LNG portfolio players (aggregators) and trading houses emerged in the 2000s and 2010s, respectively, as intermediaries between LNG producers and end users.[118] Four giant LNG aggregators are BP, Naturgy, Shell, and TotalEnergies, and the four largest trading houses active in the LNG market are Glencore, Gunvor, Trafigura, and Vitol.[119]

In terms of volume, the share of LNG portfolio players' procurement contracts among all active LNG contracts increased from 26% in 2016 to 40% in 2021, with similar levels maintained in 2022.[120] *Bernstein* estimates that 11 of the world's largest commodity traders notched trading earnings of $77 billion in 2022, more than double their numbers in 2020 and 2021.[121] Almost half of these earnings, or around $37 billion, were generated by Shell, BP, and Total, and the private trading trio Vitol, Gunvor, and Trafigura made about $28 billion together.[122]

Aware of the emergence of these opportunities, QE CEO Saad Al-Kaabi is upbeat about the company's trading arm and expects the company to become the world's largest trader of LNG over the next 5-10 years, a position that Shell currently holds.[123] "We are trading in about 5-10 mt (6.8-13.6 bcm) of LNG now. In the next 5-10 years, we will be the largest LNG trader in the world by far. This is ours and third-party (volumes)[124] (...) I would say the profitability of that venture is probably 20 times what I thought it could be."[125]

Shipping is also a critical component of the QE LNG marketing strategy and can play an essential role in helping Qatar maintain its position as a leading global LNG exporter. By investing in shipping infrastructure and logistics, Qatar can ensure that its LNG is transported to international markets at

a competitive price. It offers high flexibility in seaborne transport because LNG carriers can transport LNG to different markets depending on demand. This flexibility can help QE respond quickly to changing market conditions and optimize its supply chain operations.
Qatar's *Nakilat* possesses the world's largest LNG carrier fleet in operation, currently comprising 74 vessels. This fleet includes 69 LNG carriers, four LPG carriers, and one floating storage degasification unit. *Nakilat* holds significant strategic importance for Qatar, which is expected to grow even further as it implements its ambitious two-phase North Field expansion.[126] The company has already ordered 65-70 new tankers and could reach close to 100 by investing $20 billion in shipping alone.[127]

In the context of shipping, two academic studies suggest that the most favorable outcome arises from selecting a diverse array of ships involved in tasks with multiple discharges while using LNG as the preferred bunker fuel. This approach results in lower total transportation costs and reduced emissions compared with other scenarios. The current use of LNG as a fuel presents itself as a distinct, viable, and economically sound approach to curbing carbon emissions within the maritime shipping sector.[128]

While Qatar has a cost advantage in the LNG industry, engaging in a price war in the LNG market may not be a sustainable long-term strategy. Price wars can lead to a race to the bottom in pricing, ultimately hurting all LNG producers, including Qatar. Importantly, by engaging in partnerships with oil majors, QE could obtain technical support for its projects, recoup a percentage of the incurred financial costs, secure offtake by selling a portion of gas into majors' portfolios, and further facilitate QE's foray into frontier markets including Europe.[129]

Yet, US LNG producers are particularly susceptible to this aspect (Qatar's cost advantage), as they should manage risk at both ends of the value chain. This arises from their exposure to the costs of feed gas in US spot markets and the prices they receive upon delivery in European and Asian markets.

• Taking Decarbonization Seriously

LNG is expected to maintain a positive outlook, driven by factors such as the shift from coal and oil to gas, the emergence of more efficient carbon capture technologies for power production, and its use in specialized transportation sectors.[130] However, LNG is increasingly challenged on environmental grounds, given its more limited emission reduction potential compared with other low-carbon energies. To ensure that gas plays more than a transitional role in the global energy mix, it is imperative to prioritize the transition of gas supply toward greener alternatives.[131]
An IEA report recently examined the immediate steps that the gas industry should take. It identifies four key levers to significantly reduce its emissions footprint and help move the world closer to meeting its international energy and climate goals.[132] This includes tackling methane emissions; eliminating all non-emergency flaring; electrifying upstream facilities with low-emission electricity, and equipping gas processes with carbon capture and storage (CCS).[133]

Considering these environmental challenges, Qatar has acted decisively by directing its investments toward innovative technologies and actively seeking methods to diminish the environmental impact of LNG production. Qatar has taken steps toward enhancing the eco-friendliness of its LNG production and is taking further steps to ensure its place in the emerging energy transition.

QE unveiled its updated sustainability strategy in 2022, which calls for a 35% reduction in the carbon intensity of the country's LNG facilities by 2035 and at least a 25% reduction at its upstream facilities (compared with previous targets of 25% and 15%, respectively), by further deploying CCS technology.[134] QE is investing significantly in decarbonizing its LNG, as approximately $250 million has been spent on carbon mitigation technologies for the North Field expansion, including CCS and solarization of power for facilities.[135]

Meanwhile, QE began constructing two new solar power plants in the industrial area in 2022 to generate 800 megawatts of power. This will partially supply power to the new LNG trains in Qatar to reduce the carbon footprint.[136] In addition, all ships ordered by Qatar (around 70-plus vessels) will be run by LNG-fueled engines, using the most efficient engines available today.[137]

Table 10: QatarEnergy's Green Push

	Target	By Year
Carbon Capture and Storage	11 mt/y	2035
Solar Power	5 GW	2035
Carbon intensity (LNG)	35% reduction	2035
Carbon intensity (upstream)	25% reduction	2035
Methane Emissions	0.2 wt%	2025
Zero routine flaring		2030
CCS	Increase the CCS capacity to 7-9 mt/y CO_2.	2030 and increase the CCS capacity to more than 11 mt/y CO_2.
All the new ships that Qatar ordered (around 70-plus ships)	LNG-fueled engines	2027

Source: QatarEnergy 2022 Sustainability Report, https://tinyurl.com/33wyj8nn

Although CCS has recently gained prominence as a leading climate technology, it still encounters significant challenges, particularly concerning cost, regulation, and public acceptance.[138] According to the *Global CCS Institute*, the current worldwide rates of carbon capture and storage (CCS) implementation fall significantly short of the levels projected in modeled scenarios aimed at restricting global warming to 1.5°C-2°C.[139]

A scholarly study found that valuable lessons learned from feasibility studies and the application of CCS in industrial settings have highlighted substantial challenges, such as considerable cost increases for industrial plants and increased associated risks.[140] *Wood Mackenzie* expects that opting for lower-carbon LNG will lead to a premium price, but it is not without its associated costs. For particularly carbon-intensive ventures, this could translate to an additional expense of up to US$2/MMBtu (one million metric British thermal units) on the delivered cost when supplying jurisdictions that impose a carbon price on imports (based on a US$100/t carbon price assumption).[141]

That being said, during its most recent gathering in Japan in April 2023, the G7 extended its backing for the ongoing advancement of natural gas and carbon capture and storage (CCS) infrastructure to enhance energy security, contingent upon its contribution to the progress of renewable energy and sustainability endeavors.[142] The recent statement by the Climate, Energy, and Environment Ministers of the G7, advocating for the extensive implementation of CCS along with other climate mitigation strategies to swiftly decrease emissions and achieve net-zero goals, has been positively received by the *Global CCS Institute*.[143]

In the broader economy, Qatar is investing substantially in various solar power initiatives, such as solar desalination plants, solar-powered manufacturing facilities, and large-scale solar power plants.[144] These endeavors are crucial in establishing the infrastructure to foster a robust and flourishing solar power sector.

As stated by the International Renewable Energy Agency (IRENA), Qatar will have a combined renewable energy capacity of 824 megawatts (MW) in 2022. This capacity was divided into 805 MW from solar energy and 19 MW from bioenergy, constituting 7.2% of Qatar's total electricity capacity.[145] Despite the rather low and short-term targets set for renewable energy, the Qatari government has announced that the country is likely to exceed the 20% solar energy production level by 2030.[146]

However, the availability of abundant and low-cost gas reserves in Qatar challenges the economic viability of solar projects in the country. Significantly increased end-user power prices would be necessary to warrant substantial construction expenses associated with renewable energy projects.[147] A recent academic paper concluded that electricity prices in Qatar will not be sustained in the long term, as the country will need to decarbonize its grid system.[148]

• Going Global

QE is also seeking to expand its international footprint by acquiring stakes in exploration acreage across different basins[149], reflecting a growing desire to diversify its portfolio, improve market access, enhance its ability to swing volumes between various demand centers and become a global player.[150] For Qatar, the aim is apparent, or as the Minister of State for Energy Affairs, Saad Al-Kaabi put it bluntly: "We want to be with the main players. We don't see ourselves as a national oil company per se anymore. We look at ourselves like any other IOC. We always say we want to be one of the best, if not the best."[151]

The QE has set a goal to achieve a daily production of 500,000 barrels of oil equivalent by 2030. In an impressively short span of six years, QE has successfully built an extensive international presence that spans approximately 81 blocks on four continents.[152] QE is also developing the 18.1 mt/y (24.6 bcm) Golden Pass LNG project in Texas (US) in partnership with ExxonMobil. QE's upstream investments have involved partners in the North Field expansion.[153]

Table 11: QatarEnergy's Upstream Shopping Spree, April 2017-March 2023

Lead Partner on Block	
ExxonMobil	25
TotalEnergies*	22
Eni	21
Shell	13
Total	**81**
By Country	
Morocco	12
Argentina	12
Mexico	11
Brazil	11
South Africa	5
Namibia	4
Mozambique	4
Canada	4
Kenya	3
Cote D'Ivoire	2
Suriname	2
Egypt	3
Guyana	2
Cyprus	2
Lebanon	2
Angola	1
Oman	1

*On the Guyana and Brazil blocks, TotalEnergies is not an operator. ***Source:*** QatarEnergy, https://tinyurl.com/bdeurrzv

In addition to its 70% stake in the Golden Pass LNG project, in November 2022, QE partnered with Chevron Phillips Chemical Co. LLC to sanction a combined polymer facility worth $8.5 billion in the eastern region of Houston, United States.[154] In the same month, QE joined forces with ExxonMobil to secure a bid for offshore oil and gas areas in the Orphan Basin of Newfoundland and Labrador, Canada.[155]

Qatar is also further targeting Europe by expanding its buyer base, degasification capacity, and assets on the continent, where it is the region's second-largest LNG supplier after the US.[156] QE has long leased some 17 mt/y (23.12 bcm) of re-gas capacity in three European terminals, adding to its capabilities at South Hook in the UK and Adriatic LNG.[157] Qatar also gained a 9% share in German utility company RWE AG in October 2022 by helping fund the acquisition of US solar and wind power projects.[158]

Table 12: New Gas Behemoth: Growth Since April 2017

LNG	Capacity (mt/y)	Partners	Targeted Start-Up	QatarEnergy Stake %
North Field East	32	TotalEnergies, ExxonMobil, Royal Dutch Shell, Eni, ConocoPhillips, Sinopec, and CNPC	2026	72.5%
North Field South	16	TotalEnergies, Royal Dutch Shell, ConocoPhillips	2027	75%
Golden Pass	18	ExxonMobil	2024-25	70%
New Downstream Projects				
Projects	**Capacity (mt/y)**	**Notes**	**Targeted Start-Up**	**QatarEnergy Stake %**
Ras Laffan II	2.08	$6 billion patches projects; with Chevron Phillips	2026	70%
Golden Triangle Polymers	2.08	$8.5 billion US projects with Chevron Phillips	2026	49%
Ammonia-7	1.20	$1.16 billion Blue Ammonia projects	2026	70%
European regas capacity				
Terminals	**Capacity (mt/y)**	**Notes**		
South Hook*	15.6	67.5% stake in the re-gas project with ExxonMobil and Total		
Adriatic LNG*	6.6	22% stake in the re-gas project with Exxon		
The Isle of Grain	7.2	The 25-year lease for re-gas, signed in 2020		
Montoir-de-Bretagne	3.2	Lease signed in 2020		
Zeebrugge	6.6	Doubling the existing re-gas capacity lease with an extension to 2044		

* Predates April 2017. ***Source:*** Qatar Energy, Energy Intelligence, https://tinyurl.com/mtacjpmp

However, one of the boldest endeavors pursued by QE is its engagement in TotalEnergies' ambitious $27 billion multifaceted initiative in Iraq. This comprehensive undertaking integrates both traditional hydrocarbon activities and sustainable energy solutions, encompassing aspects such as oil production, gas processing, solar energy deployment, and a critically important water re-injection facility. Within this substantial agreement, TotalEnergies will exercise a controlling interest of 45%, partnering alongside the state entity Basrah Oil Company (BOC), which will hold a 30% stake, while QE will possess 25%.[159]

Although some of QE's recent international investments have already yielded positive results, the continuous increase in international farm-ins exposes the company to investment risks, such as dependence on joint venture partners and operational challenges in emerging markets.[160] Most of QE's recent farm-ins have provided the company with large non-operated 25%-30% stakes in gas-prone offshore blocks, leaving other international oil companies as operators. This requires QE to allocate significant resources to effectively oversee and manage business activities in markets where they may need more extensive prior experience.[161] However, for QatarEnergy, such a strategy, despite its risks, yields many strategic benefits, the most important of which is turning the company into a global player.

• Qatar's Diversification Plan

LNG is only part of a multifront; QatarEnergy also aims to capitalize on robust global demand for ethane-based petrochemicals, recognized as a cleaner alternative to chemicals obtained from crude oil or naphtha.[162] QE announced last January (2023) that it had taken a final investment decision (FID) on its $6 bn Ras Laffan Petrochemical Project (RLPP) alongside partner Chevron Phillips (30%).[163] The Ras Laffan petrochemical complex is expected to begin production in 2026. It consists of an ethylene cracker with a capacity of 2.08 mt/y. Once operational, the project will be the largest facility in the Middle East and one of the largest in the world.[164]

Another primary focus and interest for Doha is the potential of the global hydrogen industry. In 2022, QE subsidiaries Qatar Fertilizer Company (QAFCO) and QE Renewable Solutions announced plans for the world's largest blue ammonia[165] plant.[166] The project cost could run over $1 billion, will be developed by Germany's ThyssenKrupp and Greece's Consolidated Contractors Company, and is expected to come online in the first quarter of 2026, producing 1.2 mt/y.[167]

Blue ammonia could be regarded as a superior and more environmentally friendly interim fuel than LNG, leading toward a future centered on green hydrogen. Numerous academic studies have shown a favorable outlook on blue ammonia, and it is currently considered the optimal choice, mainly because of Qatar's abundant gas resources. This could enable Qatar as one of the first movers to enter the expanding market for clean fuels, encompassing various sectors such as transportation, power generation, steel, cement, and fertilizer.[168]

At the macroeconomic level, while Qatar has been actively pursuing its diversification plan to reduce its reliance on hydrocarbons, the country is still heavily dependent on its fossil fuel revenues, which have been the mainstay of its economy for decades. Based on the *Global Economic Diversification Index*, a country will be classified as reliant on commodities if its resource rents constitute more than 10% of its GDP *OR* if the proportion of commodities in its exports surpasses 60%. Using Qatar as a case in point, the country's GDP relied on resource rents for over 50%, and the portion of mineral fuels in its overall merchandise exports amounted to nearly 88% in 2022.[169]

Worryingly, Qatar LNG supplies are currently 100% dependent on Ras Laffan and shipping through the Strait of Hormuz. Any disruptions in this regard will be a blow to Qatar's economy and global LNG markets.[170] Given the considerable growth in LNG, petrochemicals, and blue ammonia, hydrocarbon products will continue to maintain their predominant position in exports for the foreseeable future.[171]

Table 13: Qatar's Export Structure in 2022

Total exports	**130.96 billion US$**
~ 87.29% (114.32 billion US$)	Mineral fuels, mineral oils, and products of their distillation; bituminous substances; and mineral waxes
~ 22.71% (16.64 billion US$)	Others include fertilizers and chemicals

Source: ITC, Trade Map, https://tinyurl.com/2s3t5mpc

In this specific circumstance, a piece of academic research conducted by a trio of scholars pointed out that Qatar's entirety technological, structural, and political configurations were crafted to maximize advantages stemming from fossil fuel-based systems, thereby upholding the dominance of the hydrocarbon-centric structure. This situation enforces noteworthy technological and economic constraints to achieve a socio-technical shift in Qatar.[172]

6. Conclusion and Future Research

Considering Qatar's present economic trajectory, it is clear that the existing socio-technical systems reliant on fossil fuels will likely continue to hold a prominent role in the foreseeable future. This primarily stems from a significant reliance on investments in fossil fuels, such as LNG, petrochemicals, and blue ammonia. These investments play a pivotal role in promoting economic progress, enhancing the well-being of individuals, and bolstering government finances.

Nevertheless, the upcoming decade is projected to witness growing competition within the energy market. As a result, Qatar ought to focus on preserving its status as a prominent provider of cost-effective LNG, enhancing its environmental standing and bolstering its geopolitical significance. In this scenario, Qatar must improve its technological edge, cost-effectiveness, and operational efficiency.

In this context, subsequent research should prioritize various critical domains that have the potential to propel Qatar's liquefied natural gas (LNG) sector forward while tackling its evolving challenges.

- **Supply Chain Resilience:** Enhancing the resilience of the LNG supply chain against disruptions, such as natural disasters, geopolitical conflicts, or pandemics, should be a priority. This could involve developing flexible sourcing strategies and adaptable logistics networks.

- **Market Dynamics and Pricing:** Analyzing the evolving dynamics of the global LNG market, including regional demand trends and price fluctuations, can inform investment decisions and regulatory frameworks.

- **Green Hydrogen:** Investigating the potential shifts in market demand for LNG due to the rise of green hydrogen is an area of research. Researchers might study how the increasing adoption of green hydrogen as an energy source affects LNG prices, trading patterns, and overall demand.

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DECLARATION OF COMPETING INTEREST

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