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Article

Global Gas and LNG Markets: Demand, Supply Dynamics, and Implications for the Future

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Abstract: This article provides a comprehensive analysis of the global gas and liquefied natural gas (LNG) markets. The article begins by discussing the increasing demand for gas and LNG, particularly in Asia, as countries aim to transition to cleaner sources of energy. It explores how market volatility has led to energy security interventions and lasting economic and emissions impacts. It then explores the global supply and demand dynamics, highlighting the structural change expected in the market and the competition between Europe and Asia for limited new LNG supply. The article also focuses on Europe's increased flexibility and dependence on LNG imports, which have risen by 60% to 121 million tonnes, offsetting lower Russian pipeline imports. Furthermore, the article delves into global supply and demand dynamics, how the market is expected to remain tight, and how record gas and LNG prices have led to demand reductions. Additionally, it analyzes the future outlook and investment needs, highlighting the continued uptake of gas in heavy-duty transport and the need for further investment to avoid a supply-demand gap. The article concludes with an analysis of the implications for the future of the global gas and LNG markets.

Keywords: global gas; LNG; supply and demand dynamics; market outlook; investment needs

1. Introduction

Market volatility is a key driver of energy security concerns. It has the potential to disrupt the supply of energy resources, leading to price spikes and market imbalances [13]. The COVID-19 pandemic has also contributed to market volatility in the energy sector, as the global economic slowdown has reduced demand for oil and gas, leading to a drop in prices [1].

The impacts of market volatility on energy security can be long-lasting. For example, in the aftermath of the 2008 financial crisis, many countries implemented policies to promote renewable energy and energy efficiency in order to reduce their dependence on volatile fossil fuel markets [16]. These policies have had a lasting impact on the energy landscape, with renewable energy now accounting for a significant share of global electricity generation [5].

To address market instability and energy security worries, worldwide policies have been enacted. The International Energy Agency (IEA) has urged greater investment in renewable energy and efficiency to decrease reliance on fossil fuels [7]. The European Union has introduced directives such as the Renewable Energy Directive and the Emissions Trading System to encourage renewable energy and diminish greenhouse gas emissions [14].

The Shell LNG Outlook 2023 predicts significant market volatility in the global energy industry. This volatility will trigger interventions to enhance energy security, but will have lasting economic and emissions impacts. Europe is expected to benefit from the flexibility of the LNG industry in 2022, as the continent increases its LNG imports by 60% to 121 million tonnes to offset lower Russian pipeline imports. The US is expected to lead global supply growth with an additional 6 million tonnes. Overall, the market volatility remains a barrier to achieving energy security, but policy interventions aimed at promoting renewable energy and energy efficiency can help mitigate the impacts of market disruptions [18].

Looking ahead, a comprehensive overview of the LNG market shows that continued market volatility and the uncertainty of global energy demand growth will drive policymakers to focus on

enhancing energy security and promoting renewable energy alternatives. As the world transitions towards a low-carbon future, LNG will continue to play an important role in meeting the world's energy needs. However, the industry must adapt to changing market dynamics and invest in cost-competitive energy alternatives to remain competitive and sustainable.

2. Materials and Methods

To conduct the analysis presented in this article, a comprehensive review of existing literature, reports, and data on global gas and liquefied natural gas (LNG) markets was conducted. The following materials and methods were employed: Data Collection, data on global gas and LNG markets, including supply and demand dynamics, market trends, and investment opportunities, were collected from reputable sources such as international energy agencies, industry reports, and scholarly publications. Literature Review, a thorough review of relevant literature was conducted to gather insights into the current state of global gas and LNG markets, as well as emerging trends and challenges. The literature review involved identifying key studies, reports, and academic papers that provided valuable information on the subject.

The analysis also involved identifying challenges and investment opportunities in the global gas and LNG markets. Market Outlook based on the analysis of the collected data, a comprehensive market outlook was developed, highlighting the expected trends, challenges, and investment opportunities in the global gas and LNG markets. The outlook considered factors such as supply and demand dynamics, market volatility, energy security interventions, and economic and emissions impacts. The findings from the analysis and market outlook were synthesized to draw conclusions regarding the implications for the future of global gas and LNG markets. Key insights, challenges, and investment needs were identified and discussed in the context of the evolving energy landscape.

3. Overview of LNG Global Market

The global liquefied natural gas market has experienced significant disruption and unprecedented high prices following Russia's invasion of Ukraine in February 2022, which led to a decline in Russian pipeline gas shipments to the European Union. The resulting high demand for LNG from EU buyers led to record global spot prices and a reduction in the volume of LNG available to developing economies.

The LNG market is facing new risks to demand growth due to high prices and supply disruptions, which have led to delays and cancellations of proposed LNG import projects in Asia. Additionally, key LNG growth markets are implementing new policies aimed at reducing dependence on global gas imports, which could negatively impact long-term demand in regions that were expected to drive robust growth in the LNG industry.

In contrast, European countries have increased their LNG imports to compensate for the declining pipeline gas shipments from Russia. However, the EU's climate and energy security policies are expected to reduce gas demand by at least 40% through 2030, which could cause a potential fall in LNG demand after 2023. Europe's import capacity could increase by a third by the end of 2024 through the addition of new LNG terminals, but a considerable portion of this new capacity may go unused because of the continent's energy transition objectives [4].

High prices, COVID-19 shutdowns, slower economic growth, and rising concerns about fuel supply security and affordability are all causing Japan, South Korea, China, and South Asia to reduce their LNG purchases. Instead, they are relying more on alternative energy sources such as nuclear, wind, and solar power generation, lower-cost Russian pipeline imports, and domestic gas production [9]. Southeast Asia faces challenges due to high prices, limited LNG contract availability, and infrastructure constraints. Long-term contracts with delivery dates prior to 2026 are said to be sold out globally, leaving price-sensitive Southeast Asian buyers vulnerable to volatile and expensive spot markets.

The global gas and LNG markets are expected to evolve as market dynamics point to a structural change. The market is expected to remain tight until the mid-2020s as Europe and Asia compete for limited new LNG supply. The LNG supply is expected to reach 80 million tonnes, which is 60% of the total gas supply of 140 million tonnes. However, gas and LNG prices are expected to hit record levels in 2023 due to reduced gas imports from Russia, which will increase the use of coal in power generation in Germany [17].

As a result of high prices, industrial users in major European markets are expected to reduce their average gas use by 16% compared to 2021. LNG could become a core energy supply for Europe to meet its energy security needs. In 2023, China's LNG imports are expected to fall by 15 million tonnes (or 19%) following strict Covid measures. Similarly, South Asian LNG imports are expected to drop by 5.8 million tonnes due to high prices [10].

The global LNG trade is expected to rise to 397 million tonnes, an increase of 16 million tonnes compared to 2021. There will be continued uptake of gas in heavy-duty transport, and the majority of new LNG supply to 2030 is expected to come from the US and Qatar. However, without further investment, a supply-demand gap will still loom.

The impact of high LNG prices will spur fuel switching, including coal use in Asia, which will have an impact on global emissions. The number of operating LNG vessels is expected to increase to 521, while there are 130 LNG vessels on order. There are currently 635 LNG fuelling stations in Europe, some with Bio LNG, and 39,600 LNG and Bio LNG fuelled vehicles. China is expected to provide more flexibility to the global LNG market in the future [12].

The International Energy Agency (IEA) has reported that natural gas markets worldwide continued to tighten in 2022 despite a 1.6% decline in global consumption. The demand for natural gas is projected to remain unchanged in 2023, but Russia's future actions and fluctuating energy prices make the outlook uncertain [10]. Europe's gas demand decreased by 13%, and Asia's by 2% due to high liquefied natural gas (LNG) prices, COVID-19 related disruptions in China, and mild weather conditions in Northeast Asia.

Global LNG trade will have more than doubled to USD 450 billion by 2022, with traded volumes increasing by 6%. The modest 5.5% increase in supply, on the other hand, was due to maintenance at large liquefaction ports and a long outage at Freeport in the United States. According to the IEEFA, global LNG prices will remain structurally high for several years due to weak supply growth and strong demand. Global LNG markets may remain tight until significant new supply comes online later this decade, causing periodic disruptions, according to McKinsey & Company's Global LNG Market Outlook report [4].

According to the same report by McKinsey & Company (2021), the COVID-19 pandemic has accelerated structural shifts in the energy sector, particularly the transition towards cleaner and more diversified energy sources. The report suggests that LNG stakeholders should focus on adapting to these shifts by investing in low-carbon technologies and exploring new business models that can deliver value in a changing market.

As the global LNG industry continues to expand, the risk of oversupply remains a critical concern for market participants, including producers, traders, and investors. The COVID-19 pandemic and its impact on global energy demand have added further uncertainty to the market, highlighting the need for LNG industry stakeholders to remain vigilant and agile in responding to evolving market dynamics.

One potential strategy for mitigating the risk of oversupply is to focus on developing new markets and diversifying demand sources. This could involve targeting emerging markets with strong long-term growth potential, such as Southeast Asia, India, and Latin America, where demand for cleaner and more efficient energy sources is increasing rapidly. In addition, efforts to promote the use of LNG as a transportation fuel, particularly in the marine and heavy-duty road transport sectors, could create new demand sources and reduce reliance on traditional power generation markets [9].

Another critical factor for maintaining market stability and avoiding oversupply is effective coordination between industry stakeholders, including producers, traders, and regulators. Collaboration on infrastructure development, investment planning, and risk management can help ensure that new supply additions are balanced with corresponding increases in demand and adequate infrastructure to support efficient and cost-effective distribution.

Global LNG markets are expected to have limited supply additions in the coming years, and high prices will continue to lower Asian demand growth, particularly among price-sensitive emerging markets. European policymakers are taking aggressive measures to cut gas consumption and meet emissions reduction targets, which is likely to stabilize and reverse LNG demand growth on the continent later in the decade [4].

Along with declining gas consumption in Europe and global investments in cost-competitive energy alternatives, there may be a supply glut that results in lower-than-anticipated prices, smaller

netbacks, tighter margins, and lower profits for LNG exporters. These factors include sustained high prices, weak LNG demand growth, and elevated price sensitivity in Asia. While the growth prospects for the global LNG market remain robust, industry stakeholders must remain vigilant in managing the risks associated with oversupply and market volatility. Diversifying demand sources, promoting the use of LNG in new sectors, and collaborating effectively across the value chain will be critical to ensuring long-term market stability and profitability.

As the industry navigates these challenges, Europe's increased LNG imports and flexibility may provide some stability to the market. The region is expected to increase its LNG imports in order to offset lower Russian pipeline imports, which could provide some relief to exporters facing weaker demand growth in other regions. Moreover, Europe's commitment to reducing greenhouse gas emissions through policies promoting renewable energy and energy efficiency may create new opportunities for LNG as a transition fuel. The next section will explore Europe's increased LNG imports and flexibility in more detail.

4. Europe's Increased LNG Imports and Flexibility

Europe's increased LNG imports as a key factor in the global LNG market. In 2022, as mentioned, Europe boosted its LNG imports by 60% to more than 100 million tonnes, offsetting the decline in Russian pipeline gas shipments caused by the Ukraine crisis. This increase in LNG imports allowed Europe to maintain its energy security and meet its energy needs, despite the supply disruptions caused by the crisis.

According to a report by the International Energy Agency (IEA), Europe's reliance on LNG imports is set to continue in the coming years. The IEA notes that Europe's gas demand is expected to grow by 1.5% per year until 2025, with LNG imports expected to account for a significant portion of this growth [6]. This highlights the growing importance of LNG as a core energy supply for Europe, as the region seeks to meet its energy security needs.

Europe's increased LNG imports have also highlighted the flexibility of the LNG industry. The ability to redirect LNG shipments to different markets in response to changing demand has allowed the industry to respond quickly to the supply disruptions caused by the Ukraine crisis. This flexibility has been a key factor in enabling Europe to maintain its energy security and meet its energy needs, despite the supply disruptions caused by the crisis.

Europe's increased LNG imports have been a key factor in the global LNG market. The ability to redirect LNG shipments to different markets in response to changing demand has allowed the industry to respond quickly to supply disruptions and maintain energy security. With LNG expected to become a core energy supply for Europe in the coming years, the flexibility of the LNG industry will be increasingly important for meeting the region's energy needs.

The situation of oversupply in the LNG market is not new, and it has been observed before, as in 2019, where global supplies collided with weak demand, leading to a global LNG glut. However, the COVID-19 pandemic aggravated this oversupply situation, and by the summer of 2020, global LNG markets were in severe oversupply [4]. This oversupply led to lower-than-expected prices, which have been a significant concern for LNG exporters, and it is expected that the global LNG prices will remain structurally elevated for several years due to weak supply growth and robust demand [4,15].

In this context, LNG exporters will have to focus on developing strategies to cope with the volatile market conditions and remain competitive. One strategy is to optimize their liquefaction processes and logistics to lower production costs and increase profit margins. Moreover, LNG exporters could expand their customer base beyond traditional markets, such as Japan and South Korea, to other emerging markets, like China and India, which are expected to be significant drivers of global LNG demand [4].

Another strategy that LNG exporters could consider is to diversify their portfolio and invest in other forms of energy, such as renewables, which are increasingly becoming cost-competitive and could provide more stable revenue streams in the long term [15]. Additionally, LNG exporters could explore opportunities for partnerships and collaborations with other industry players, such as shipping companies, to leverage economies of scale and reduce operational costs.

In conclusion, the LNG market's volatility and oversupply have led to falling prices and lower profits for exporters, making it essential for them to develop robust strategies to cope with these

conditions. By optimizing their liquefaction processes, diversifying their portfolio, and exploring new partnerships, LNG exporters can remain competitive in a rapidly changing market and secure their long-term profitability.

In light of the current market conditions, it is crucial for LNG industry stakeholders to monitor the global supply and demand dynamics and adapt accordingly. With the expected growth in LNG demand in emerging markets and uncertainties in Europe, market participants will need to be flexible and agile in their decision-making. The ability to respond quickly to changing market conditions and identify new growth opportunities will be critical to ensuring the long-term success of the industry.

4. Global Supply and Demand Dynamics

The global gas and LNG markets have been in a state of constant evolution over the past few years. The industry has witnessed significant changes in supply and demand dynamics, driven by various factors, including economic growth, changes in energy policies, and technological advancements. The International Energy Agency (IEA) has projected that global natural gas consumption will continue to increase, driven mainly by Asian economies, including China, India, and Southeast Asia, which are expected to account for nearly half of global gas consumption by 2040 [5].

Europe has become a significant importer of LNG over the past few years, driven by the decline in domestic production, the decommissioning of nuclear and coal-fired power plants, and increasing demand for cleaner energy sources. In contrast, Asia, particularly China, has also emerged as a major LNG importer, driven by its efforts to reduce its reliance on coal and improve air quality. As a result of this intense competition, LNG prices have remained high, leading to concerns over affordability and energy security. The LNG supply-demand dynamics are expected to point towards a structural change in the market, with a shift from long-term contracts to spot and short-term contracts, which will give buyers more flexibility in responding to changing market conditions [19].

To summarize, the global gas and LNG markets are forecasted to undergo further evolution, which will be driven by several factors, including alterations in energy policies, advancements in technology, and global economic growth. The changing market dynamics are expected to usher in a structural transformation, which highlights the need for the industry to adopt more flexible contract structures to meet evolving buyer requirements and ensure long-term sustainability. As a result, market participants must remain vigilant and proactive in their approach to adapt to the changing market conditions and remain competitive [18].

According to the International Energy Agency (IEA), global natural gas demand is expected to increase by 1.2% per year until 2025, driven primarily by Asian economies, particularly China and India. However, the rate of growth is expected to slow after 2025 due to increasing competition from renewable energy sources and a push towards decarbonization. On the supply side, the IEA projects that global natural gas production will increase by 1.6% per year until 2025, with the majority of the growth coming from the United States, Russia, and the Middle East.

The global LNG market is forecasted to witness a 45% increase in liquefaction capacity between 2020 and 2026, primarily owing to the initiation of fresh projects in countries such as the United States, Russia, Australia, and Qatar. Nevertheless, in the short to medium term, the demand for LNG is expected to surpass its supply, with Asia and Europe vying for restricted new supply. IEA predicts that prices would persistently remain high owing to the continued growth in demand coupled with the challenges faced in augmenting the supply [10].

The competition for limited new supply is particularly acute in Europe, where demand for natural gas and LNG has surged due to the closure of coal-fired power plants and the retirement of nuclear reactors. However, Europe is facing increasing competition for LNG from Asia, particularly China, which is expected to overtake Japan as the world's largest LNG importer by the mid-2020s. This competition for limited new supply is expected to keep prices high and create opportunities for LNG traders and exporters to capture value.

Overall, the global gas and LNG markets are expected to face structural changes that will shape the industry for decades to come. Despite the expected growth in the short term, there are concerns about increasing competition from renewable energy sources and a push towards decarbonization. The competition for limited new supply is particularly acute in Europe due to the closure of coal-

fired power plants and the retirement of nuclear reactors, leading to a surge in demand for natural gas and LNG.

However, Europe is also facing increasing competition for LNG from Asia, particularly China, which is expected to overtake Japan as the world's largest LNG importer by the mid-2020s. This competition for limited new supply is expected to maintain high prices and create opportunities for LNG traders and exporters to capture value. To navigate the highly competitive and dynamic global gas and LNG markets, industry stakeholders must develop robust strategies that address the challenges of oversupply, market volatility, and changing demand patterns.

4. Future Outlook and Investment Needs

The global LNG trade has been increasing in recent years. In 2021, global LNG trade reached 381 million tonnes, and it is expected to rise further to 397 million tonnes in 2022 [17]. This trend is driven by the increasing demand for natural gas, particularly in the heavy-duty transport sector, as countries seek to reduce their carbon emissions. The use of LNG in heavy-duty transport has increased significantly, particularly in Europe and Asia, where there is a strong focus on decarbonization.

In the US, several new LNG export terminals are under construction, which will significantly increase the country's LNG export capacity. Qatar is also expanding its LNG production capacity, with plans to increase its annual LNG production from 77 million tonnes to 126 million tonnes by 2027. However, despite the expected increase in supply, there is a need for further investment to avoid a potential supply-demand gap. Demand for natural gas continues to grow in emerging markets such as China and India [15]. To meet this demand, significant investment is required in new liquefaction plants, LNG carriers, and infrastructure such as storage tanks and regasification facilities.

China is the world's largest LNG importer, accounting for 20% of global LNG imports in 2020 (International Gas Union, 2021). The country has been expanding its LNG import infrastructure and is increasingly using short-term and spot LNG contracts to meet its growing demand for natural gas [15].

China has also been increasing its role in the global LNG market by increasing its LNG imports and investing in LNG infrastructure. China became the world's second-largest LNG importer in 2021, surpassing South Korea, and it is expected to continue to be a major driver of global LNG demand growth [20]. Moreover, China has been increasingly using LNG to improve the flexibility of its natural gas supply, as LNG can be transported and stored more easily than pipeline gas. This flexibility is important for China, which has experienced supply disruptions due to pipeline gas disputes with Russia [3].

The majority of new LNG supply is expected to come from the US and Qatar, but further investment is required to avoid a potential supply-demand gap. China is also playing an increasingly important role in the global LNG market, providing more flexibility to LNG suppliers. In terms of investment needs, the growth of global LNG demand and the retirement of older liquefaction plants will require significant investment in new liquefaction capacity. However, this investment may face challenges, including the need for long-term contracts to secure financing and the increasing competition from renewables in the power sector [2].

5. Conclusions

This article highlights the current state of the global gas and LNG markets, with an emphasis on the supply and demand dynamics, pricing trends, and investment needs. The global gas and LNG markets have experienced significant growth over the past few years, driven by the increasing demand from Asia and the adoption of gas in heavy-duty transport. However, this growth has also led to a supply-demand gap and a decline in prices in certain markets, emphasizing the need for further investment in new supply infrastructure.

Looking towards the future, the majority of new LNG supply until 2030 is expected to come from the US and Qatar, with China playing an increasingly important role in providing flexibility to the global LNG market. While the future of the global gas and LNG markets seems to be one of continued growth and evolution, it is essential to note that the market will face challenges such as supply-demand imbalances and competition from renewable energy sources. The increasing role of China in the global LNG market is providing more flexibility to the market and contributing to its growth, but there are still challenges with existing facilities and slow supply growth.

The future of LNG demand growth is uncertain due to various factors such as concerns over fuel supply security and affordability, a decrease in gas consumption in Europe, and the investment in cost-competitive energy alternatives over the next few years. To avoid a supply-demand gap, further investment in infrastructure and technology will be necessary. It is clear that the global LNG market will continue to evolve and face challenges, and it is crucial for market participants to stay informed and adapt to changing market conditions. Thus, strategic investment and collaboration between industry stakeholders are necessary to ensure a sustainable and stable market.

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