

# The Global LNG Market: Development Factors, Competitive Strategies, and Prospects for Russia

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## Abstract

This article analyzes the key factors influencing the development of the liquefied natural gas (LNG) industry in three countries—Australia, the United States, and Iran—and their potential application to the strategic development of the Russian LNG sector. The study encompasses economic, technological, and geopolitical aspects that determine the competitiveness of LNG projects, and identifies the main barriers and drivers of growth. Particular attention is paid to the impact of sanctions, investment policies, and market conditions on export opportunities. Based on the analysis of the experiences of these three countries, three main models of LNG industry development are identified: regulated balancing (Australia), the liberal market model (U.S.) and limited isolation (Iran). These models provide insight into how various factors—such as domestic energy policy, geopolitical risks, technological dependence, and competition—shape the development trajectories of the industry. The article also presents a scenario analysis of the future development of the Russian LNG sector, considering global trends and strategic challenges. Recommendations are proposed for risk management and strengthening Russia's position in the global LNG market, including diversification of partnerships, advancements in indigenous technological capabilities, and targeted investments in small-scale projects.

**Keywords:** LNG, Australia, The United States, Iran, Russia, geopolitical risks

## 1. Introduction

The modern global energy landscape is undergoing a profound transformation driven by both technological innovations and geopolitical shifts. A key element of this transformation is the rapid development of the LNG market, which is becoming an increasingly important component of the global energy system. LNG not only provides flexibility in energy resource supplies but also plays a crucial role in ensuring the energy security of many countries, especially amidst growing instability in traditional hydrocarbon markets.

Russia, possessing some of the world's largest natural gas reserves, aims to strengthen its position in the global LNG market. However, achieving this ambitious goal requires not only significant investments and technological solutions but also a deep understanding of the experiences of other countries that have already developed their LNG projects. In this context, analyzing the successes and challenges faced by countries such as Australia, the United States, and Iran becomes critically important for shaping Russia's strategy in this area.

Studying these cases allows us not only to identify key factors contributing to the successful development of LNG projects but also to understand what risks and barriers may arise in implementing ambitious plans. For Russia, which aims to triple its LNG production and reach 140 million tons by 2035 (The Russian Government, 2021), this analysis becomes particularly relevant. Given the current geopolitical challenges and sanctions pressure, Russia must not only adapt the best practices of other countries but also develop unique strategies that will allow it to strengthen its position in the global LNG market.

In this article, we will conduct a detailed analysis of the experiences of Australia, the United States, and Iran to identify key drivers and barriers to LNG industry development. Based on this analysis, recommendations will be proposed for Russia to help it not only achieve its goals but also minimize the risks associated with global competition and geopolitical instability.

## 2. Literature Review

The global LNG market has witnessed remarkable growth, presenting both opportunities and challenges for established and emerging players. This literature review examines the nuanced development paths of the LNG industries in Australia, the United States and Iran, gleaned insights that inform potential strategies and address

critical challenges for the Russian LNG sector. The study of factors driving the development of the LNG industry has been a significant subject of both theoretical and practical research.

### *2.1 Australia*

The literature on the Australian LNG industry identifies large-scale infrastructure investment and long-term contracts with Asian nations as critical factors enabling the country to become a major LNG exporter. Meza et al. (2021) underscores the magnitude of Australia's LNG export capacity, highlighting the significant investments made in liquefaction facilities and export terminals. This study emphasizes the long-term contracts that underpin Australia's LNG industry, providing revenue stability and attracting further investment. These findings are further supported by McConnell and Sandiford (2020). Vivoda (2022) provides further evidence that diversification is a key element and Australia's emergence as a leading LNG exporter is rooted in its vast natural gas reserves, strategic location, and a commitment to large-scale infrastructure development.

However, Flottmann J. (2024) introduces a critical perspective by examining the environmental consequences of Australian LNG production. This study raises concerns about the greenhouse gas emissions associated with LNG extraction, processing, and transportation, as well as the potential impacts on water resources and biodiversity. The authors advocate for the adoption of sustainable development practices, including carbon capture and storage technologies, to mitigate the environmental footprint of the industry.

Studies on Australia show that the country achieved success through strategic investments and long-term contracts. However, growing domestic challenges, such as the energy transition and environmental restrictions, require deeper analysis. The potential conflicts between export obligations and increasing domestic gas demand are also under-studied.

### *2.2 U.S.*

Research on the U.S. consistently highlights a combination of factors as the key to its leading position in the global LNG market.

The transformative impact of shale gas extraction on the US LNG landscape cannot be overstated. Zhukov et al. (2019) meticulously dissect the factors contributing to American LNG's global competitiveness. Beyond the abundance of shale gas, they emphasize the importance of deregulation, which fostered innovation and attracted private capital, allowing for a rapid build-out of liquefaction and export facilities. The authors highlight how the U.S. adopted a flexible, market-oriented approach, enabling it to respond swiftly to global demand shifts and price signals. They also discuss the influence of geopolitical factors.

Konoplyanik (2022) offers a focused analysis of U.S. LNG's growing presence in the European market, framing it within the context of energy security and geopolitical competition with Russia. The author examines how U.S. LNG has become a crucial source of diversification for European nations seeking to reduce their dependence on Russian natural gas. He dives into price dynamics, infrastructure constraints, and the evolving political landscape, arguing that U.S. LNG serves both economic and strategic objectives for the EU. However, this paper acknowledges the potential trade-offs for Europe, including higher prices and potential dependence on U.S. suppliers.

Meza et al. (2021) reinforces the argument for market-driven competitiveness. This paper underscores how competitive pricing, fueled by low production costs and efficient liquefaction processes, has enabled U.S. LNG to gain market share globally. The study highlights the significance of Henry Hub as a benchmark for pricing and its influence on the global LNG market. McConnell and Sandiford (2020) extends this analysis by investigating export diversification strategies. This research highlights the importance of a geographically diverse customer base to mitigate risks associated with regional economic downturns or geopolitical instability. By securing long-term contracts with key players in Asia and Europe, U.S. LNG exporters have enhanced their revenue stability and secured their position in the global market.

Studies concerning the U.S. LNG industry underscore the role of technological innovation, market adaptability, and geopolitical strategy in driving its market success. However, there is a tendency in the literature to concentrate on realized achievements, resulting in a relative neglect of potential challenges such as environmental concerns and political shifts. Moreover, the longer-term implications of U.S. market expansion into Europe for global energy security merit further scholarly investigation.

### *2.3 Iran*

Investigations into Iran's LNG industry development predominantly aim to analyze the factors, both internal and external, preventing the country from fully exploiting its capabilities in this sector. Soltani et al. (2021) explores

the key factors influencing the competitiveness of Iran's natural gas industry. The study examines various internal and external factors, including production costs, infrastructure limitations, regulatory policies, and geopolitical risks. The authors emphasize that sanctions have significantly hampered Iran's ability to compete in the global LNG market. They further stress that the competitiveness of the Iranian gas industry is affected by political risks and the legal structure, particularly because they discourage foreign investment.

Sarraf et al. (2022) offers an analysis of the legal and commercial challenges facing LNG projects in Iran. This study focuses on the legal and contractual complexities, including issues related to investment security, dispute resolution, and contract enforcement. The authors discuss Iran's efforts to attract foreign investment in LNG projects, but note that these efforts have been largely unsuccessful due to legal and commercial uncertainties.

Rahbar et al. (2023) utilizes the Fuzzy Delphi Method to identify the primary reasons behind the failure of Iran's gas export through LNG. The study uses expert opinions to rank and prioritize the factors that have hindered Iran's LNG development, in order to build a clearer picture of the problem. The authors also emphasize that the sanctions and technological barriers have been key in stunting LNG growth.

Nowrouzi et al. (2019) proposes a conceptual framework for optimizing Iran's natural gas export portfolio, based on portfolio theory. The study recognizes that Iran faces a complex and uncertain export environment, characterized by political risks, market volatility, and contractual uncertainties. The framework is focused on mitigating risks so that Iran can pursue its LNG goals. The author notes that if these risk mitigation strategies are not put into place, the sector will continue to stagnate.

Telegina, and Fedorova (2016) provides an overview of the potential for LNG industry development in Iran. The authors discuss Iran's natural gas reserves and the potential benefits of becoming an LNG exporter. However, they emphasize that the Iranian LNG industry has been slow to develop due to international sanctions, a lack of foreign investment, and technological constraints.

Research on Iran consistently identifies sanctions and internal limitations (e.g., lack of technology and investment) as key barriers to LNG development. However, the literature primarily analyzes problems, neglecting concrete solutions. Furthermore, opportunities for cooperation with non-sanctioned countries remain underexplored, representing a promising area for future research.

#### *2.4. Strategies And Risks Of LNG Exporting Countries*

Although the LNG industry has exhibited considerable development in the United States and Australia and faced setbacks in Iran, the scholarly investigation into a comprehensive, systematized analysis of factors that impact LNG development remains limited. Prior studies tend to focus on national level experiences in isolation, often lacking an integrated assessment of these factors within the international context. This research directly addresses these shortcomings through the synthesis of disparate knowledge, creating a robust framework for classifying LNG industry drivers, intended to inform policy decisions for state energy authorities, and enable existing and potential exporters to better navigate and accelerate industry development based on previous experiences.

A review of the existing literature reveals that the trajectory of LNG sector development across diverse national contexts is shaped by the interplay of internal and external factors. Internal factors encompass resource endowments, technological capabilities, and the regulatory framework, whereas external factors, such as sanctions regimes, geopolitical volatility, and competitive dynamics in the global marketplace, may either facilitate or constrain sectoral development.

However, there are several gaps in existing research. First, most works focus on analyzing successful cases (U.S., Australia), while the problems of countries facing sanctions (Iran) remain under-studied. Second, insufficient attention is paid to the long-term consequences of LNG industry development, including environmental and social aspects. Third, few studies are devoted to analyzing the interaction between internal and external factors, which could help in developing more comprehensive strategies for countries seeking to strengthen their positions in the global LNG market.

This article builds upon the work of Vivoda (2019), Heffron et al. (2021), and Hafner and Tagliapietra (2020), which examine the strategies, risks, and competitive advantages of key LNG exporters. Vivoda (2019) focuses on the evolution of the LNG market, comparatively analyzing the strategies employed by the United States, Australia, and Russia, with specific attention to pricing mechanisms, technological advancements, and risk management approaches. The author highlights the United States' dominance, driven by contract flexibility and the shale revolution, while emphasizing the geopolitical and environmental challenges confronting Russia and Australia.

Expanding on this comparative framework, Heffron et al. (2021) present a risk matrix for key LNG exporters. They identify five primary risk categories – geopolitical, economic, environmental, technological, and social – and

analyze how different countries address these challenges. For instance, the United States exhibits low economic risk but high social risk, whereas Russia faces substantial geopolitical threats.

Hafner and Tagliapietra (2020) underscore the competitive advantages of Australia, the United States, and Russia within the global LNG market. They emphasize that success hinges on a combination of factors, including resource access, robust infrastructure, and supportive policy frameworks. For example, the United States benefits from low production costs, while Russia leverages its Arctic-based projects.

However, our analysis extends beyond these existing studies by incorporating Iran into the comparative framework, analyzing its specific market strategy, and proposing a novel risk matrix tailored to this nation. Furthermore, we identify commonalities across the strategies of Australia, the United States, Iran, and Russia, thereby providing a more nuanced understanding of the dynamics within the global LNG market.

The aforementioned studies (Vivoda, 2019; Heffron et al., 2021; Hafner and Tagliapietra, 2020) primarily cover the period leading up to 2021, a time characterized by significant transformation in the global LNG market. However, recent years have witnessed profound shifts, including the European energy crisis (2021–2023), increasingly stringent climate policies, and the imposition of new sanctions regimes (e.g., against Russia post-2022). Our research, while grounded in the contributions of prior scholarship, accounts for these recent developments, thereby enabling a more timely and relevant analysis of the strategies and prospects of key LNG exporters.

Finally, this article offers prospective insights for Russia, taking into consideration prevailing geopolitical and economic challenges, thus contributing meaningfully to the ongoing discourse concerning the future of LNG.

### 3. Methodology of the Research

This research employs a comparative case study methodology, focusing on three nations—Australia, the United States, and Iran—each representing a distinct model of LNG industry development. These countries were selected based on their significance within the global LNG market and the unique confluence of factors influencing their sectoral trajectories.

The research comprised the following stages:

1. **Data Acquisition:** Secondary sources were utilized, encompassing statistical reports (e.g., EIA data, BP Statistical Review), governmental documents, corporate annual reports, and peer-reviewed scholarly publications. Emphasis was placed on acquiring data pertaining to production capacities, export volumes, infrastructure investments, and the impact of sanctions regimes.
2. **Comparative Analysis:** Based on the acquired data, a comparative analysis was conducted to identify key drivers and barriers to LNG industry development in each country. The analysis differentiated between:
  - **Internal Factors:** resource endowments, technological capabilities, energy policy frameworks, and environmental regulatory requirements.
  - **External Factors:** sanctions regimes, geopolitical risks, competitive pressures, and long-term contractual arrangements.
3. **Classification of Development Models:** Based on the comparative analysis, three distinct models of LNG industry development were identified:
  - **Regulated Balancing Model (Australia):** characterized by a balanced approach to export commitments and domestic demand, coupled with a proactive role for the state.
  - **Liberal Market Model (United States):** characterized by robust competition, market adaptability, and technological innovation.
  - **Constrained Isolation Model (Iran):** characterized by the imposition of sanctions regimes, technological dependencies, and the absence of competitive pressures.
4. **Scenario Analysis and Risk Assessment:** Three potential scenarios for the Russian LNG sector (optimistic, baseline, and pessimistic) were considered, coupled with an assessment of the probabilities and potential consequences of key risks (e.g., sanctions, technological dependence, competitive pressures).
5. **Conclusions:** Based on the findings, strategic recommendations are proposed for mitigating risks and consolidating Russia's competitive position, including diversification of partnerships, advancements in indigenous technological capabilities, and targeted investments in small-scale projects.

#### 4. Current State of the Global LNG Market

The global LNG market has demonstrated sustained growth in recent years, driven by both increasing demand for energy resources and shifts in the structure of international gas trade.

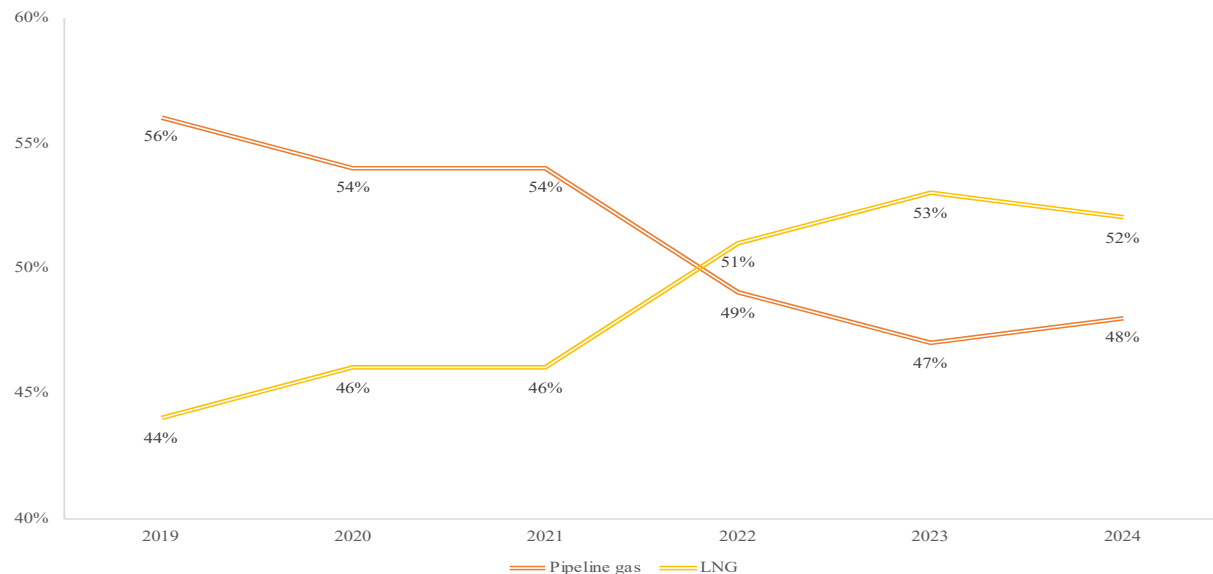


Figure 1. International natural gas trade structure: net export share by type (% of total volume)

According to estimates from the Global Gas Report (IGU, 2024), international LNG trade overtook pipeline gas deliveries in the overall structure of international natural gas trade in 2022. Figure 1 illustrates the changes in the structure of international natural gas trade. By the end of 2023, the share of LNG reached 53%, while the share of pipeline deliveries declined to 47%. It is important to note that the structure of international natural gas trade was the reverse before 2022, with pipeline gas deliveries playing a dominant role. However, the reduction in pipeline gas supplies from Russia to Europe, coupled with the launch of new LNG projects, has altered this landscape.

Global operational liquefaction capacity increased by 19.9 million tonnes in 2022, reaching 480.3 million tonnes (IGU, 2023). The global LNG market was distributed among 22 exporting countries in 2022. Figure 2 illustrates the geographic distribution of operational LNG liquefaction capacity. The major exporters included the United States with a market share of 18.3%, Australia with 18.2%, Qatar with 16.1%, Malaysia with 6.6%, and Russia with 6.1%. Collectively, these five largest exporters accounted for approximately 65% of the total capacity (Fatianov, 2024).

In recent years, particular attention has been paid to the growth in LNG demand in the Asia-Pacific region, which remains a key market for exporters. Simultaneously, Europe, seeking to reduce its dependence on Russian pipeline gas, is actively increasing its LNG imports, creating new opportunities for exporters such as the United States and Qatar.

Thus, the contemporary LNG market is characterized by high dynamism, intensifying competition, and shifting geopolitical priorities. These trends create both new opportunities and challenges for countries seeking to strengthen their positions in the global market, including Russia.

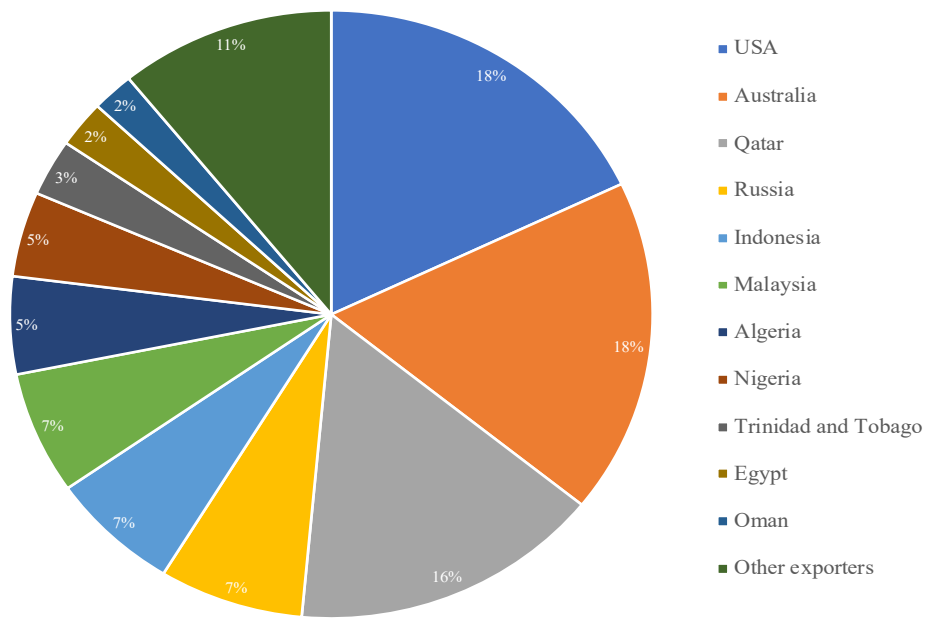


Figure 2. Geographic distribution of operating LNG liquefaction capacity as of year-end 2022 (%)

This study will consider both the positive experiences of countries like Australia and the United States, as well as the experience of Iran. The reference group is limited to countries that planned to commission LNG projects with a combined capacity of over 30 million tons per year, starting in 2010. It is important to note that Iran is not currently an active LNG exporter; however, the country planned to actively expand its production capacity in the early 2010s, with the potential production volume of the prospective projects listed in Table 3 estimated at 70 million tons per year. It should also be noted that the experience of Qatar, which implemented a significant portion of its projects before 2010, will not be considered among the major suppliers.

**5.The Results of Research**

*5.1. Australia Case*

Australia has been chosen as a focus for this study primarily owing to its considerable achievement in expanding LNG production several-fold, as illustrated in Figure 3, thereby establishing itself as a leading global exporter.

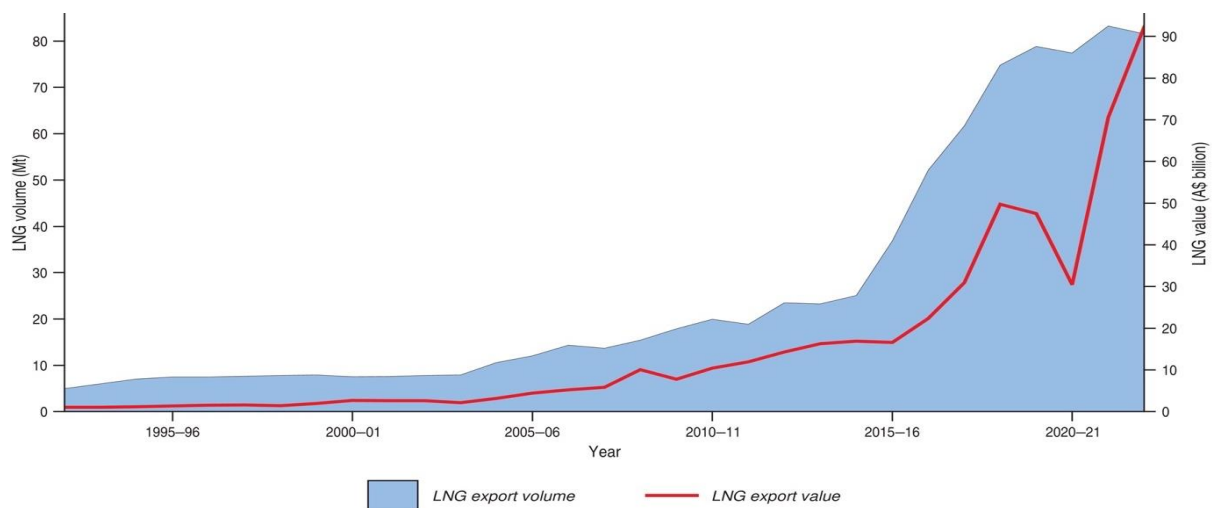


Figure 3. Trends in Australian LNG export volumes and values

The Russian Federation has articulated ambitious objectives to strengthen its position in the global LNG market, comparable to the targets previously pursued by Australia. Furthermore, the potential contraction in LNG exports as a result of current challenges in the domestic energy market, driven by increasing energy demand and difficulties in the energy transition from coal-fired generation to renewable energy, is of considerable practical relevance.

According to data from BP (2020), Australia is ranked 15th worldwide in terms of proven natural gas reserves, accounting for 1.2% of global reserves. Australia ranks seventh globally in natural gas production, following the United States, Russia, Iran, China, Canada, and Qatar. Meanwhile, it holds the second-largest operating LNG liquefaction capacity worldwide, as shown in Figure 2, trailing only the United States. Moreover, data from the IEA (2023) indicate that around 80% of domestic natural gas output is processed into LNG for export. Figure 3 illustrates the trends in export volume and value. The most significant growth occurs during the mid-2010s, corresponding to the period when seven new LNG projects were commissioned. The surge in export value can be explained by a beneficial price environment in preceding years, driven by limited supply in global markets.

The example of Australia demonstrates the factors that can influence the long-term prospects of export-oriented LNG projects. These factors can be specified as follows:

1. Internal factors:

- *Accelerated phase-out of coal-fired generation*, creating increased domestic demand for natural gas;

Like many other countries, Australia is undergoing an energy transition with a growing share of renewable energy sources. As an arid continent, Australia has limited water resources. Although the country is one of the largest uranium exporters and is in the process of acquiring nuclear submarines, it does not have nuclear power generation, which is due to the long-standing state policy. A significant portion of electricity generation depends on coal. On the east coast of the country, approximately 60% of electricity is generated from coal, although this figure is gradually decreasing. Some coal-fired power plants were built back in the 1970s. These facilities, which were intended to provide a stable baseload, are becoming increasingly unreliable, given the frequent outages and gradual reduction in operational activity, leading to their eventual closure. In such a situation, preconditions for crisis situations are created, where coal-fired generation is decreasing, while demand for electricity is increasing and not fully covered by renewable energy sources. This leads to increased demand for gas-fired generation. However, given the limited capabilities and depletion of reserves from existing production projects, the government is forced to develop mechanisms that allow or encourage LNG producers to divert their own resources to cover the needs of the domestic market. According to OIES estimates (2023), LNG production in Australia could decrease to 65-70 million tonnes by 2030 from the current 82 million tonnes in 2022 due to the redistribution of supplies in favor of the domestic market at the expense of export supplies.

Table 1 details the operational capacity and launch year of key Australian LNG projects. The projects listed represent an Australia's LNG export capacity, illustrating the scale of investment and the phased development of the industry from the late 1980s to the late 2010s. Notably, the majority of this growth occurred in the last decade, with recently launched projects accounting for 58% of current total capacity.

Table 1. LNG projects in Australia

| Project               | Capacity, million tonnes/year | Project Launch Year |
|-----------------------|-------------------------------|---------------------|
| NWS LNG               | 16.7                          | 1989                |
| Darwin LNG            | 3.7                           | 2006                |
| Pluto LNG             | 9.9                           | 2012                |
| Queensland Curtis LNG | 8.5                           | 2015                |
| Australia Pacific LNG | 9.0                           | 2015                |
| GLNG                  | 7.8                           | 2015                |
| Gorgon LNG            | 15.6                          | 2016                |
| Wheatstone LNG        | 8.9                           | 2017                |
| Ichthys               | 8.9                           | 2018                |
| Prelude FLNG          | 3.6                           | 2018                |

Source: Compiled by the author based on the World LNG report (IGU, 2023)

- Reduced investment in exploration and development of new fields;

This leads to a reduction in the country's proven reserves, as the rate of development of existing fields exceeds the rate of discovery of new fields that should replace them in the future. The dynamics of investment in exploration of new fields, shown in Figure 4, suggest that Australia peaked in the period from 2006 to 2015, when it actively developed new projects in the oil and gas sector, after which there was a multiple-fold decrease in activity (Australian Bureau of Statistics, 2024).

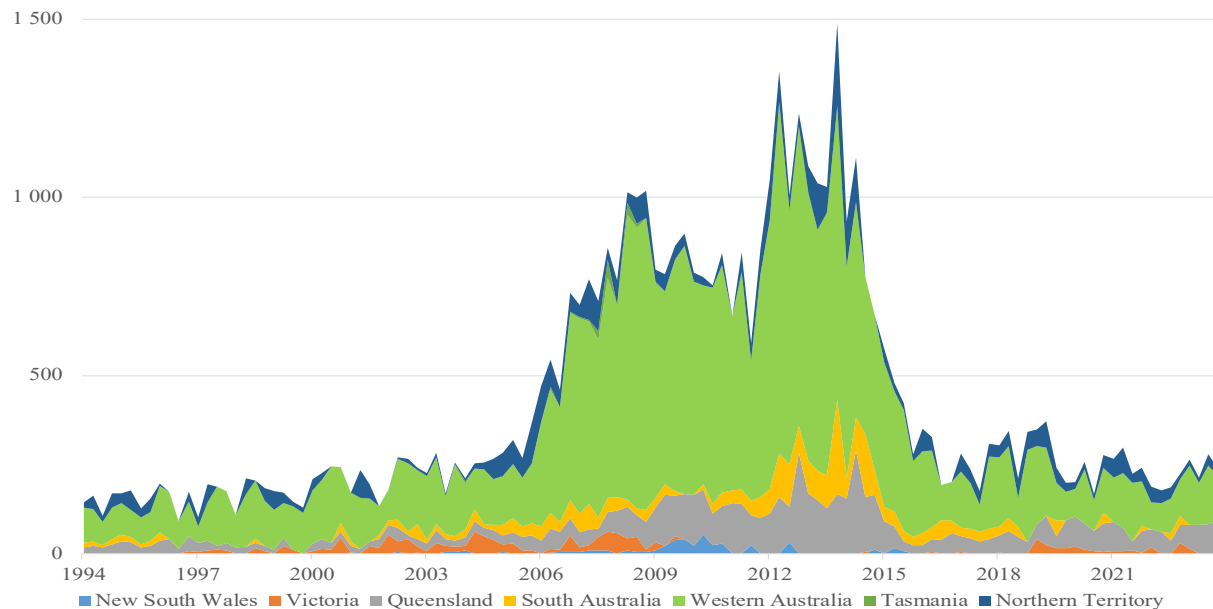


Figure 4. Dynamics of investment in mineral exploration by state and territory, million USD

– *Internal energy policy;*

The existing Australian Domestic Gas Security Mechanism (ADGSM) makes it possible to redirect natural gas from LNG production to cover shortages in the domestic market and to set threshold prices in the domestic market. The situation is exacerbated by the isolation of the three gas production regions. Thus, a reduction in gas supplies to consumers in one production region cannot always be compensated by supplies from another region via pipeline transport. There is also no way to redirect flows from the west to the east coast.

Increased environmental requirements for new projects also play a significant role in slowing down the development of new projects. The greatest challenge is the requirement for new projects to achieve zero emissions from the very first day of operation, which implies significant investments in carbon capture and storage projects and reduces the investment attractiveness of projects.

2. External factors;

- *Long-term obligations under existing contracts for LNG supplies to Asian markets;*

Increased domestic demand for natural gas, combined with existing long-term obligations under LNG supply contracts, creates certain contradictions. On the one hand, violating contractual obligations to foreign partners could lead to direct financial losses, both in the form of lost profits and possible litigation due to under-deliveries. Given the structure of LNG exports from Australia, if supplies to foreign markets are reduced to cover domestic needs, the main impact will be on Asia-Pacific countries.

The concern of Asian countries is primarily due to potential problems with LNG projects in Australia, given the country's current policies, including new mechanisms that allow for the redirection of supplies from existing LNG projects. According to EnergyQuarterly estimates (2022), around 90% of LNG supplies from Australia go to Japan (38% of supplies), China (28%), South Korea (15%), and Taiwan (10%), while Australia's share in the market of each of these countries is at least 25% of the total imported LNG. In this regard, the concerns of major buyers, such as Japan, for which supplies from Australia account for 43% in volume, seem quite justified

The example of Australia demonstrates the factors that can influence the long-term prospects of export-oriented LNG projects. Currently, it can be stated with confidence that the growth seen in Australia during the 2010s will not be repeated. This is due to the fact that only one project, Pluto LNG with a capacity of 5 million tonnes, is currently under construction, with deliveries expected in 2026.

The main problem for LNG projects in Australia in the long term is the potential intervention of the state to meet domestic market needs and the coercion of LNG producers to redirect export flows to the domestic gas market under the ADGSM mechanism. The state’s consistent policy in the field of developing and stimulating the development of renewable energy sources, combined with the accelerated pace of coal generation reduction, has led to imbalances in the domestic market and increased demand for natural gas, which was required to cover the deficit.

5.2 U.S. Case

While Australia has most likely already experienced its peak in the LNG market, the position of the United States, which rapidly topped the list of the largest exporters in less than 10 years since the launch of the first Sabine Pass project in 2016, has the potential for further strengthening. By the end of 2022, production capacity reached 88 million tonnes per year. Table 2 provides an overview of operational U.S. LNG export projects, specifying their capacity in million tonnes per year and the years in which they commenced operations. It highlights the significant investments made in U.S. LNG infrastructure between 2016 and 2022, resulting in substantial export capacity additions. Considering prospective projects, it can increase to 148 million tonnes by 2029 due to the implementation of projects such as Port Arthur LNG (2 lines), Corpus Christi (7 lines), Golden Pass LNG (2 lines), and Plaquemines LNG (36 lines).

Table 2. LNG projects in U.S.

| Project            | Capacity, million tonnes/year | Project Launch Year |
|--------------------|-------------------------------|---------------------|
| Sabine Pass        | 28                            | 2016-2022           |
| Cove Point         | 5,25                          | 2018                |
| Cameron LNG        | 13,5                          | 2019-2020           |
| Elba Island        | 2,5                           | 2019-2020           |
| Corpus Christi     | 13,5                          | 2019-2021           |
| Freeport LNG       | 15,3                          | 2019-2020           |
| Calcasieu Pass LNG | 10                            | 2022                |

Source: Compiled by the author based on the World LNG report (IGU, 2023)

The main factors determining the long-term prospects of the LNG industry in the United States include the following:

- *Faster growth in natural gas production compared to the growth of domestic consumption;*

As a result of the “shale revolution,” the rate of growth in natural gas production observed since the early 2010s exceeds the rate of growth in domestic demand. As production levels increased, the United States became a net exporter of natural gas for the first time since 1956 in 2017. The dynamics of key U.S. indicators for natural gas are presented in Figure 5.

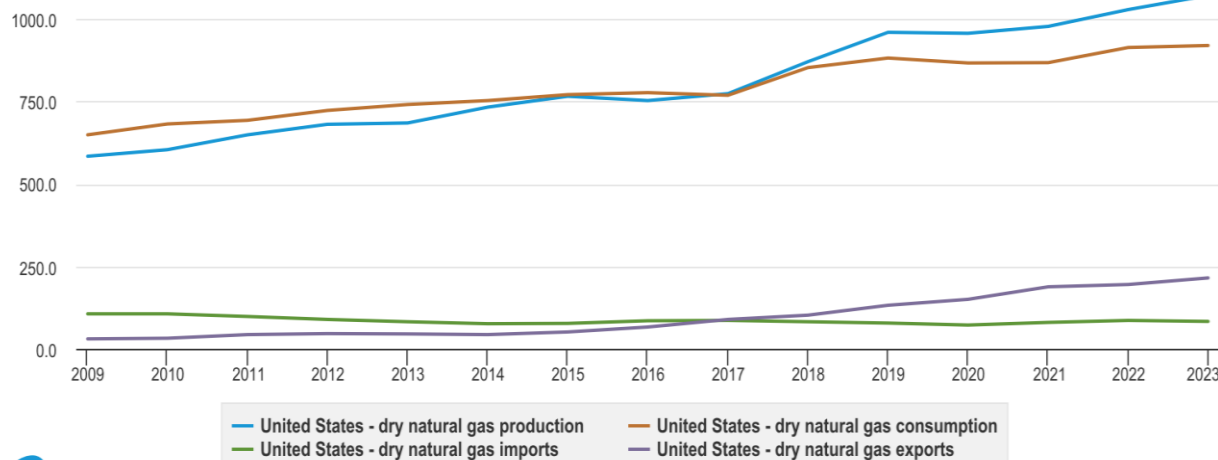


Figure 5. Dynamics of U.S. natural gas production, consumption, imports, and exports, bcm

Geographical features allowed the country to greatly increase the volume of pipeline supplies to Mexico and Canada, which account for 71% and 29%, respectively, of the total volume of pipeline exports (IEA, 2025). However, it should be noted that imports of natural gas into the United States from Canada exceed the volume of exports. A substantial proportion of the gas, however, is allocated for export to the global LNG market, where the footprint of U.S. projects is steadily increasing with the commissioning of new facilities. The proportion of pipeline exports relative to LNG exports is illustrated in Figure 6.

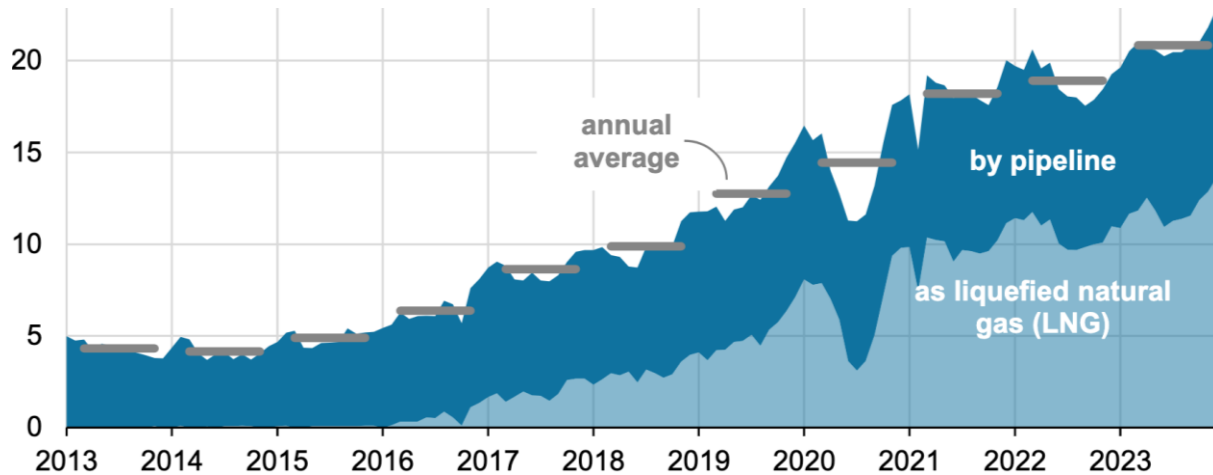


Figure 6. Dynamics of U.S. pipeline gas and LNG exports, billion cubic feet per day

- Declining costs of U.S. LNG due to growing supply and heightened competition amongst LNG terminals;

A significant portion of the natural gas produced in the U.S. is associated gas extracted during oil production. Currently, substantial volumes of associated gas in the Permian Basin are subject to atmospheric emissions or flaring due to the limited capacity of pipeline infrastructure for transportation to consumers. Investment decisions for drilling new wells are made by oil companies, with gas production being a byproduct of oil production. Moreover, up to 75% of gas production is expected to be associated gas, which is inelastic to changes in market gas prices (Zhukov et al., 2019). It should be noted that as pipeline infrastructure expands towards the Gulf of Mexico, increased gas supplies in the Henry Hub area will exert downward pressure on prices.

The rapid growth of the LNG industry in the U.S. and the entry of new players into the market are contributing to increased competition among existing LNG plants. As new projects are commissioned, there is potential for reducing liquefaction fees, creating conditions for increased attractiveness to potential energy buyers.

- Dependence on political course;

The adoption of various initiatives in the energy sector depending on changes in the political climate has a noticeable impact on the development of the LNG industry.

Among the most notable is the decision to temporarily suspend the issuance of new permits for LNG exports from the U.S., adopted in January 2024 by the Biden Administration. This decision does not affect existing projects and permits but pauses the approval of new export terminals. The main argument was the need to reassess the impact of export LNG projects on the climate and the environment. The administration stated plans to revise the project assessment process to more accurately account for climate impacts.

Such decisions directly affect the realization of export potential, as a ban could slow down the development of new LNG projects in the U.S., potentially reducing future export volumes and having a negative impact on relations with key partners who need additional supply volumes.

- Implementation of aggressive plans to expand and secure a presence in the European gas market;

Geographical features make Europe a priority sales market for the U.S. Most LNG plants in the U.S. are located in the Gulf of Mexico, from where minimal transportation costs are achieved when supplying to Europe compared to other major sales markets in Asia and the Asia-Pacific region. Transporting gas to Asia requires passing through the Panama Canal, Africa, or Latin America, which involves high time and monetary costs.

From an economic perspective, U.S. LNG supplies have consistently lost the competitive battle against Russian pipeline gas in the Northwest European market, even at the regasification terminal exit, without considering the cost of transporting this raw material as network gas to end-users located deep within continental Europe (Konoplyanik, 2022).

However, as the energy crisis in Europe developed in 2022, programs to reduce dependence on Russian pipeline gas began to emerge. The International Energy Agency's program proposed substituting 30 billion cubic meters, while the REPowerEU program aimed for 50 billion cubic meters. Thus, it was intended to increase purchases of American gas from new projects and redirect supplies from the Asia-Pacific region. The activation of non-economic measures with political motivation became a priority option in the U.S.'s struggle against natural gas supplies from Russia. Following the sabotage of the Nord Stream pipelines in 2022, the displacement of Russian pipeline gas from the European market by American LNG became a significant element of the pressure exerted on Russia market by American LNG became a significant element of the pressure exerted on Russia (Sechin, 2024).

- Changing business models of LNG projects;

As the global LNG industry evolves, a significant growth in small and medium-sized LNG lines is expected. As interest in exploring smaller volumes of hard-to-reach gas increases, and access to financing for LNG projects and buyers becomes more competitive, small and medium-sized lines may become a less risky alternative.

The U.S. experience in implementing projects such as Elba Island (9 lines at 0.25 million tonnes per year), Calcasieu Pass LNG (18 lines at 0.5 million tonnes per year), as well as planned projects such as Plaquemines LNG (36 lines at 0.5 million tonnes per year) and Corpus Christi (7 lines at 1.4 million tonnes per year), confirms the trend towards an increase in projects that incorporate the construction of more lines based on modular technologies with lower capacity. Previously, the vast majority of projects consisted of several large-tonnage lines or "mega-projects".

Thanks to the smaller size of LNG lines, simple configurations, and standardization, modular solutions can provide savings in cost and time for project implementation. For example, in early 2022, Venture Global LNG began operations at its Calcasieu Pass LNG plant using BHGE's single mixed refrigerant (SMR) liquefaction technology, with each liquefaction module having a capacity of 0.56 million tonnes. per year.

### 5.3 Iran Case

The Islamic Republic of Iran has been chosen as an object of analysis owing to the following considerations:

1. Iran possesses a substantial wealth of natural resources and ranks among the foremost nations globally with regard to reserves of both oil and gas. Numerous large gas fields are concentrated within the territory of the republic, a significant portion of which are located in the southern region and within the Caspian Sea;
2. The nation is subject to a considerable array of constraints imposed by Western states, which results in associated difficulties in trade with other nations that harbor concerns regarding secondary sanctions or, alternatively, find themselves ensnared in a phenomenon commonly referred to as "overcompliance," wherein economic entities apply an unduly restrictive interpretation of current regulations;
3. The unrealized potential in the international trade of LNG despite its extensive natural resource base.

In the early 2000s, a range of projects were proposed in an effort to amplify Iran's presence in global energy markets, notably including: Iran LNG, Pars LNG, Persian LNG, Golshan LNG, North Pars LNG, and Qeshm LNG. Table 3 provides a list proposed LNG projects in Iran. The collective capacity of all projects identified is approximately 70 million tonnes per annum (Rahbar et al., 2023).

Table 3. Proposed LNG projects in the Islamic Republic of Iran

| Project        | Capacity, million tonnes/year | Planned Project Launch Year |
|----------------|-------------------------------|-----------------------------|
| Iran LNG       | 10                            | 2010                        |
| Pars LNG       | 10                            | 2010                        |
| Persian LNG    | 16                            | 2014                        |
| North Pars LNG | 20                            | -                           |
| Golshan LNG    | 10                            | -                           |
| Qeshm LNG      | 3-3,5                         | -                           |

Despite plans to implement several large-scale projects, only the Iran LNG project reached the direct construction phase. Construction of the plant was suspended in the mid-2010s due to sanctions imposed against the country. At the time of the project's suspension, its readiness was estimated at 40%, and the investment in the project amounted to approximately \$2.5 billion USD (Telegina and Fedorova, 2016). The key blow to the project was dealt after the adoption of the U.S. Comprehensive Iran Sanctions, Accountability, and Divestment Act of 2010 (CISADA).

Sanction limitations, combined with the lack of domestic technological capabilities, have constituted a fundamental hurdle to the execution of the proposed projects within the country. With regard to initiatives originating from Russia, and in the context of prevailing global conditions in addition to heightened sanctions

Table 4. Sanction restrictions against Iran at different stages of the value chain

| LNG Project Stage     | Scope of Sanction Restrictions  |
|-----------------------|---|
| Design                | -Conducting scientific and commercial research.   |
| Extraction            | -Construction, expansion, and reconstruction of production and transport infrastructure;<br>- Equipment for the operation of oil and gas pipelines.   |
| Transportation        | -Laying pipelines into or through Iran;<br>-Construction, expansion, and reconstruction of production and transport infrastructure.   |
| LNG Production        | -Infrastructure for the production and transportation of LNG;<br>- Goods and services capable of supporting or strengthening the functioning of the oil and gas sector.   |
| Transportation        | -Tankers for transporting oil and LNG;<br>-Sanctions against the insurance of Iranian shipping;<br>-Insurance and reinsurance in favor of the National Iranian Oil Company (NIOC) and the National Iranian Tanker Company (NITC).         |
| Financial Settlements | -Designation of the National Iranian Oil Company (NIOC) and the National Iranian Tanker Company (NITC) as entities linked to the IRGC and prohibition of foreign banks from opening and operating bank accounts within U.S. jurisdiction. |

Source: Authors' assessment

Pressure, it is necessary to note several specific attributes pertaining to the restrictions directed against Iran.

First, the sanctions targeting LNG have demonstrated a tendency for intensification over time - although the previous sanctions under ISA did not restrict the production of LNG within Iran, the CISADA legislation broadened the scope of the sanctions regime to encompass restrictions on investment in Iranian LNG ventures as well as the supply of LNG tankers. The exception to this was the interlude in the mid-2010s that followed the temporary relaxation of sanctions as a result of the JCPOA agreement, an interlude that was short-lived, following a shift in U.S. governmental leadership.

Second, the imposed constraints upon the Iranian LNG industry demonstrate a comprehensive character, summarized in Table 4, encompassing the entire value chain of LNG initiatives from initial project documentation through to the settlements with counterparties (Mastepanov A. et al., 2022). This renders project implementation achievable solely under the condition of national self-sufficiency with respect to technology, equipment, and instruments for facilitating international transactions, amongst other requirements.

The presented types of restrictions have gradually evolved and are currently formalized by the legislative mechanisms of ISA (The Iran Sanctions Act), CISADA (The Comprehensive Iran Sanctions, Accountability, and Divestment Act), ITRSHRA (Iran Threat Reduction and Syria Human Rights Act), and related subordinate acts. In addition to the presented restrictions, it should also be noted that the SRE (Significant Reduction Exception) sanctions regime provides a so-called "incentive" in the event of a significant reduction in oil purchases.

This regime stimulated existing buyers of Iranian oil to significantly reduce their purchase volume every 180 days, with a reduction of 18% being considered significant. If the materiality criterion is met, banks of the states using this regime can, without the imposition of sanctions, make payments with the Central Bank of Iran or another Iranian bank under sanctions without the risk of restrictions being imposed on them.

The implementation of such "incentive" factors has long-term negative consequences, despite the legalization of payments for energy supplies. For Iran, the risks of reducing energy export volumes have increased substantially,

and there has been an urgent need for new sales markets or the expansion of existing ones, which is extremely difficult in the current geopolitical framework. In this case, buyers of Iranian oil receive a mechanism for making payments for supplies, while reducing their presence in a market threatened by secondary sanctions. At the same time, Iran's benefit was limited to a possible reduction in the "risk premium" under individual contracts, considering the simplification of the payment mechanism.

## 6. Comparative Analysis of Strategies and Risks of Key LNG Exporters

Based on the preceding analysis of the strategies employed by Australia, the United States and Iran, both commonalities characteristic of all three nations and unique elements defining their respective competitive advantages within the global LNG market can be discerned. Table 5 presents a comparative matrix of key strategic aspects, encompassing pricing models, technological approaches, and risk management frameworks. This comparative analysis facilitates not only an assessment of each nation's current market position but also the identification of emergent trends that will shape the LNG market in the coming years.

Table 5. Comparative analysis of LNG development factors by factor group and country

| Factor Group                                | Australia  | U.S.   | Iran   |
|---|--|--|--|
| Production-Related Factors (Internal)       | Increased environmental requirements (commitment for new projects to be zero emissions)  | High natural gas production growth surpassing domestic consumption, creating exportable surpluses.   | Lack of domestic technological capacity and insufficient funding constrain production growth and efficiency. |
| Structural changes / Competition (Internal) | Internal energy transition (coal phase-out) increases domestic gas demand; reduced investments in gas exploration limit future supply potential. | Increased competition among LNG terminals drives price reductions and innovation in business models. | Lack of competition due to sanctions contribute to operational inefficiencies and slow industry progress.    |
| Policy & Political Influence                | Energy policies directly shape the internal gas market and export commitments.   | Political direction exerts a significant influence on LNG industry strategy and development.         | Sanctions impose severe restrictions on the Iranian LNG sector.  |
| Trade-Related Factors (External)            | Existing long-term LNG supply contracts to Asian markets structure export commitments.   | Proactive strategies to expand market share in the European gas market shape export policies.        | Sanctions and trade restrictions significantly limit export capacity and market development opportunities.   |

Source: Authors' assessment

To better understand the potential impacts of the factors discussed in Table 5, Table 6 presents a risk assessment matrix quantifying geopolitical, economic, environmental, technological, and social risks across key LNG-producing nations: Australia, U.S., Russia, and Iran.

Table 6. Country risk assessment matrix

| Category of risk | Australia                    | U.S.                       | Iran                               | Russia                               |
|------------------|------------------------------|----------------------------|------------------------------------|--------------------------------------|
| Geopolitical     | Medium (dependence on Asia)  | Low (dominance)            | High (sanctions, isolation)        | High (sanctions)                     |
| Economic         | High (high extraction costs) | Low (contract flexibility) | High (limited access to financing) | Medium (limited access to financing) |
| Environmental    | High                         | Medium                     | Low                                | Low                                  |

|               |                           |                     |                                    |                                   |
|---------------|---------------------------|---------------------|------------------------------------|-----------------------------------|
|               | (regulatory requirements) | (fracking)          |                                    |                                   |
| Technological | Low                       | Low<br>(innovation) | High<br>(dependence on<br>imports) | Medium (technological dependence) |

Source: Authors' assessment

Based on the preceding analysis and systematization of factors according to their interaction characteristics, we can identify three fundamental development strategies in the global LNG market:

1. Regulated Balancing (Australia): Focuses on maintaining positions in export markets amidst growing domestic energy demand, significant government intervention in foreign economic activity, the energy transition, and limited investment in new production projects;
2. Liberal Market Model (U.S.): Characterized by robust competition in both the domestic market (across the entire value chain from production to processing) and the international market (export expansion into developed gas markets). This model also features support for innovation and novel business models through the active involvement of private companies;
3. Constrained Isolation (Iran): Marked by critical dependence on external sanctions, institutional weaknesses, and a lack of technological sovereignty.

The strategies outlined above represent fundamental models of industry development that provide a framework for understanding the experiences of exporting nations. Currently, Russia exhibits a hybrid model incorporating elements of both the liberal market and constrained isolation strategies. Aspects of the liberal market model include the participation of private companies in major project development and the gradual liberalization of LNG exports. However, the current geopolitical environment and sanction pressure on Russia raise crucial questions about ensuring technological sovereignty to sustain further expansion in global markets.

Table 7 summarizes key risk factors affecting Russian LNG projects, assessing their probability and potential impact. For each factor, the table outlines relevant scenarios and provides specific risk management recommendations aimed at mitigating potential negative outcomes.

The Russian LNG industry confronts a multifaceted risk environment characterized by both significant threats and potential opportunities.

1. Geopolitical and sanctions risks dominate:

The intensification of international sanctions and adverse geopolitical events represent the most salient threats to the Russian LNG sector. These factors are assessed as having a high probability of occurrence and a critical impact on industry development by limiting access to essential technologies, financial resources, and international markets, while simultaneously disrupting established supply chains. This is the biggest risk for the country.

2. Technological dependence creates vulnerability:

Reliance on foreign technologies constitutes a major vulnerability for the Russian LNG industry. This dependence, characterized by a medium probability and a significant potential impact, could impede production, processing, and transportation operations if access to critical technologies is restricted, resulting in project delays, increased costs, and potentially constrained production volumes.

3. Market and economic risks require careful management:

Declining global LNG prices present a substantial economic risk, potentially reducing the profitability of LNG projects and diminishing returns on investment. While assessed as having a medium probability, the magnitude of potential financial losses necessitates proactive mitigation strategies. Meanwhile, fluctuations in oil and gas prices and exchange rate dynamics impact the efficiency of Russian oil and gas companies, a factor that should be considered in their strategic development planning (Borodin et al., 2023).

The ongoing energy transition in the European Union presents a complex situation characterized by both challenges and opportunities. Increased pressure to adopt green energy strategies could reduce demand for LNG; conversely, LNG may be positioned as a "bridge fuel," leading to increased demand. Successful navigation of this evolving landscape requires careful strategic positioning.

Sustained growth in Asian demand offers potential benefits; however, Russia must address competition from new producers and secure favorable, long-term contractual arrangements to capitalize on this opportunity.

Table 7. Risk assessment and management strategies for Russian LNG development

| Factor                   | Risk management recommendations  |
|--------------------------|--|
| Asian Demand Growth      | <ul style="list-style-type: none"> <li>- Incentivize investment from Global South in Russian LNG projects to ensure stable demand.</li> <li>- Negotiate flexible long-term contracts with price review clauses to adapt to changing market dynamics.</li> </ul>  |
| Qatar/US Competition     | <ul style="list-style-type: none"> <li>- Focus on niche markets to mitigate volume limitations.</li> <li>- Offer competitive terms regarding delivery flexibility and long-term contracts.</li> <li>- Invest in efficiency improvements across the value chain to reduce costs.</li> <li>- Develop diversified product offerings, including LNG bunkering.</li> </ul>                                  |
| Sanction Intensification | <ul style="list-style-type: none"> <li>- Diversify partners (India, Turkey, ASEAN). - Develop sanction-resistant supply chains.</li> <li>- Establish alternative payment mechanisms.</li> <li>- Strengthen diplomatic efforts to reduce international pressure. - Explore swap arrangements with other gas-producing nations.</li> </ul>   |
| Tech Localization        | <ul style="list-style-type: none"> <li>- Invest in R&amp;D and establish new manufacturing plants to support project deployment and maintain existing infrastructure.</li> <li>- Establish joint ventures with technology providers from friendly nations to accelerate knowledge transfer.</li> <li>- Create incentives for domestic innovation.</li> </ul>   |
| Technological Dependence | <ul style="list-style-type: none"> <li>- Accelerate tech localization through joint projects with partners (China, India) to minimize sanctions risks.</li> <li>- Establish a fund to support domestic technology development in critical areas.</li> <li>- Prioritize training of Russian engineers and technicians.</li> </ul>   |
| LNG Price Decline        | <ul style="list-style-type: none"> <li>- Reduce costs (logistics optimization, tax incentives).</li> <li>- Secure long-term contracts with fixed prices.</li> <li>- Invest in small-scale LNG projects less vulnerable to global price shocks.</li> <li>- Implement hedging strategies to mitigate price volatility.</li> <li>- Develop flexible pricing mechanisms in long-term contracts.</li> </ul> |
| Political Instability    | <ul style="list-style-type: none"> <li>- Obtain political risk insurance through multilateral agreements (BRICS, SCO).</li> <li>- Engage in proactive diplomacy to foster stable relationships with key partners.</li> </ul>   |

Source: Authors' assessment

#### 4. Internal Factors are Critical for Long-Term Viability:

Successful localization of critical LNG technologies is essential for the long-term sustainability of the industry. Technological independence would reduce reliance on foreign suppliers, lower production costs, and enhance overall competitiveness.

The intensification of global competition, particularly from Qatar and the United States, presents a substantial challenge. To maintain competitiveness, Russia must focus on niche markets, optimize cost structures, and secure long-term market access.

Complementing the risk analysis presented in Table 7, Table 8 presents a forward-looking scenario analysis that examines the potential development of the Russian LNG industry. This analysis considers a range of factors, including geopolitical constraints, technological capabilities, and market dynamics, to project potential outcomes under optimistic, base, and pessimistic scenarios.

Table 8. Scenario analysis of LNG industry development in Russia

| Scenario                                | Description of conditions   | Result   |
|---|---|--|
| Optimistic: “Strategic Breakthrough”    | <ul style="list-style-type: none"> <li>- Partial easing of sanctions through political agreements (e.g., in exchange for participation in climate initiatives).</li> <li>- Successful localization of liquefaction technologies (similar to the US).</li> <li>- Long-term contracts secured with countries of the Global South (South Asia, Africa).</li> </ul> | <ul style="list-style-type: none"> <li>- Russia becomes a top-three LNG exporter by 2035.</li> <li>- Market share in Asia reaches 15-20%.</li> </ul> |
| Base Case: “Moderate Adaptation”        | <ul style="list-style-type: none"> <li>- Sanctions remain in place but are not tightened further.</li> <li>- Gradual replacement of Western technologies with Chinese and Turkish equivalents.</li> <li>- Increased spot market trading amid competition with Qatar.</li> </ul>   | <ul style="list-style-type: none"> <li>- Annual LNG export growth of 3-5%.</li> <li>- Dependence on China as the primary buyer.</li> </ul>           |
| Pessimistic: “Isolation and Stagnation” | <ul style="list-style-type: none"> <li>- Imposition of secondary sanctions against buyers of Russian LNG (similar to Iran).</li> <li>- Technological lag due to unavailability of spare parts.</li> <li>- Decreasing LNG prices.</li> </ul>   | <ul style="list-style-type: none"> <li>- Freezing of new projects (e.g., Arctic LNG-2).</li> <li>- Market share declines to 5% by 2030.</li> </ul>   |

Source: Authors’ assessment

The preceding analysis reveals that despite Russia’s considerable potential in the LNG sector, it confronts significant challenges, including the impact of international sanctions, its economic reliance on China. However, the ongoing development of Arctic-based projects and the diversification of export routes offer the potential to partially offset these challenges.

Unlike the United States, which leverages contractual flexibility and technological innovation, Russia maintains a reliance on long-term agreements, thereby exacerbating its vulnerability to market volatility. In order to mitigate geopolitical risks, Russia must accelerate the diversification of export routes, including the development of supply chains extending to India and nations within Southeast Asia. Moreover, escalating pressure from European consumers demanding a reduction in the carbon footprint associated with LNG necessitates substantial capital investment in modernization initiatives and the development of environmentally sustainable technologies. Given the successful implementation of these measures, Russia would be positioned to strengthen its standing within the global LNG market, notwithstanding current challenges.

## 8. Discussion and Conclusions

The analysis conducted reveals that the global LNG market is in a state of active transformation, driven by factors such as the shale revolution in the United States, growing demand in Asia, and the transition to new energy sources. Three distinct models of LNG industry development were identified: regulated balancing (Australia), the liberal market model (U.S.), and limited isolation (Iran). Russia, despite its vast resources and Arctic potential, faces significant geopolitical risks due to sanctions and dependence on China. To mitigate these risks, Russia should focus on diversifying its partnerships, investing in small-scale LNG projects, and advancing indigenous liquefaction technologies. Scenario analysis suggests that under optimistic conditions, Russia could become a top-three LNG exporter by 2035, while under pessimistic conditions, its market share could decline significantly. Immediate actions, such as establishing alliances with neutral actors and prioritizing R&D, are crucial to avoid the Iranian scenario of stagnation and isolation.

Each country has its own unique advantages and challenges. The United States dominates due to flexible contracts and low production costs, while Australia relies on its proximity to Asia and large-scale projects. Russia, despite its vast resources and Arctic potential, faces significant geopolitical risks due to sanctions and dependence on China.

This analysis of the LNG industry in Australia, the United States and Iran reveals a complex interplay of common and country-specific factors shaping its development. While certain underlying factors are pervasive across all three nations, their specific manifestations and relative importance vary significantly, resulting in divergent developmental trajectories.

*Among the common factors we note the following:*

- **Production Dynamics:** All three countries are profoundly influenced by their production-related factors. However, the direction of this influence differs drastically. In the U.S., high production volumes enable exports; in Australia, domestic demand pressures balance export commitments; and in Iran, production constraints stemming from technological deficits and funding gaps hinder its progress;
- **Policy and Politics:** Governmental policies and geopolitical considerations, both domestic and international, play a critical role in shaping the LNG sector in all three nations, albeit through distinct mechanisms;
- **Trade and Market Forces:** Each country's approach to international trade and contractual arrangements is fundamental to their LNG strategy. The U.S. aims to expand its market share in Europe; Australia fulfills its long-term contracts with Asian partners; and Iran faces trade barriers due to sanctions;
- **Competition:** While internal competition is a dynamic force for cost reduction and innovation in the U.S., it is also an aspect of domestic energy policy in Australia. In Iran, however, the absence of meaningful competition due to sanctions contributes to operational inefficiencies;
- **Cost and Pricing Dynamics:** Cost and pricing are critical and influenced by internal factors. However, factors such as increased supply, competition between terminals and business model innovations are impacting the cost structure in the U.S., while similar market drivers are not at play in other countries.

*Among the country-specific factors we note the following:*

- **Australia:** Australia's LNG sector is marked by a balancing act between growing internal demand due to energy transition, and existing long-term export contracts with Asian nations. It faces the challenge of sustaining production levels and meeting both domestic and international obligations, also navigating internal competition;
- **United States:** The U.S. LNG sector is characterized by a combination of abundant resources, competitive market forces, and a flexible business environment. Its strategic focus is on expansion, cost reduction, and innovation to maintain its competitive advantage in the global market;
- **Iran:** Iran's LNG sector is largely defined by external pressures, namely sanctions and related restrictions, which stifle investment, technology transfer, market access and competitive dynamics. A lack of domestic technological capacity and funding further compounds these challenges.

The development of the LNG industry in the U.S. and Australia is primarily driven by market dynamics and strategic policy decisions, while external geopolitical pressures significantly constrain Iran's progress in this sector. These factors, both shared and unique, demonstrate the complex and context-dependent nature of LNG sector development. While there is a set of fundamental drivers common to all three countries, their practical application is dependent on each country's unique economic, political, technological and geographical landscape. Understanding these nuances is crucial for both policymakers and market participants seeking to navigate this increasingly important global energy market.

The Russian LNG industry faces a complex risk landscape. While there are opportunities, the external factors, particularly geopolitical risks and reliance on foreign technology, pose the greatest threats. Addressing these challenges through diversification, technological advancements, and strategic partnerships is vital for the industry's sustained growth and success. The Probability/Impact matrix indicates that the key challenge for Russia is the combination of sanctions pressure and technological dependence. However, the country possesses a unique window of opportunity due to the growth of the Asian market.

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