

Expert Commentary

Rising Marginal Costs in LNG Liquefaction: Implications for Global Gas Trade, Investment, and Market Stability

Galia Fazeliyanova
Energy Economics Analyst

May 2026

Contents

Executive Summary	3
1. Introduction: why project status matters for cost formation.....	4
2. Analytical framework and data definition	5
3. Cost profile of existing liquefaction capacities	6
4. Cost profile of under-construction liquefaction capacities.....	8
5. Cost profile of proposed projects: the emerging cost frontier	11
6. Cross-segment comparison: structural shifts in cost dynamics	13
7. Investment and market Implications	16
7.1 Investment cycles, timing, and market balance	16
7.2 Rising structural price floor	16
7.3 Reduced supply elasticity and increased volatility	16
7.4 Reinforced role of long-term contracts.....	17
8. Conclusion.....	17
References.....	18
Definitions.....	19

Executive Summary

The global LNG market is entering a structurally different phase defined not by resource scarcity, but by rising marginal costs and increasing capital constraints. LNG trade is projected to expand significantly over the coming decades; however, the cost of incremental supply is rising materially. While existing and under-construction projects typically exhibit liquefaction costs below 3 USD/MMBtu, proposed projects are increasingly exceeding 4 USD/MMBtu - representing an increase of around 1.3-1.5 USD/MMBtu or approximately 45-55% - signalling a widening divergence between legacy capacity and future supply.

This shift reflects a deeper structural transformation rather than a cyclical cost increase. The widening gap is driven by the depletion of lower-cost opportunities, rising project complexity, increasing engineering and construction costs, and expansion into more challenging environments, including remote, offshore, and high-risk regions. As a result, future LNG supply will increasingly depend on higher-cost projects that require stronger price signals and more secure revenue frameworks to advance.

A cross-segment comparison confirms that cost dynamics are becoming more heterogeneous across the project pipeline. Existing and under-construction capacity remains relatively stable and tightly clustered, reflecting earlier investment cycles under more favourable cost conditions. In contrast, proposed projects exhibit both higher cost levels and significantly wider dispersion, highlighting growing uncertainty and variability in project economics. This dispersion is further shaped by regional and technological factors, with the Middle East maintaining its position as the structural low-cost anchor, while Asia Pacific and Eurasia represent the high-cost frontier, and Africa and North America form an increasingly competitive but diversified core.

Technological differentiation reinforces this stratification. Large-scale onshore LNG continues to underpin the lower end of the cost curve, benefiting from economies of scale and established designs. At the same time, the increasing role of modular LNG and floating LNG (FLNG), along with frontier developments, contributes to a broader spread of costs, reflecting varying degrees of standardization, scale, and execution complexity. This interaction between project stage and technology underscores a more layered and risk-sensitive cost structure across the LNG value chain.

These structural shifts are reshaping the global LNG supply curve. Existing and under-construction projects, benefiting from lower costs, form the backbone of near- to medium-term supply, while proposed projects increasingly define the marginal supply required to meet future demand. This results in a steeper and more segmented supply curve, with a clearer distinction between competitive base-load capacity and higher-cost, price-sensitive developments.

Overall, the LNG market is transitioning toward a higher structural price floor, reduced supply responsiveness, and a reinforced reliance on long-term contracting. Investment decisions are becoming more selective, increasingly contingent on pricing expectations and contractual security, with cost competitiveness and execution capability determining which projects ultimately advance.

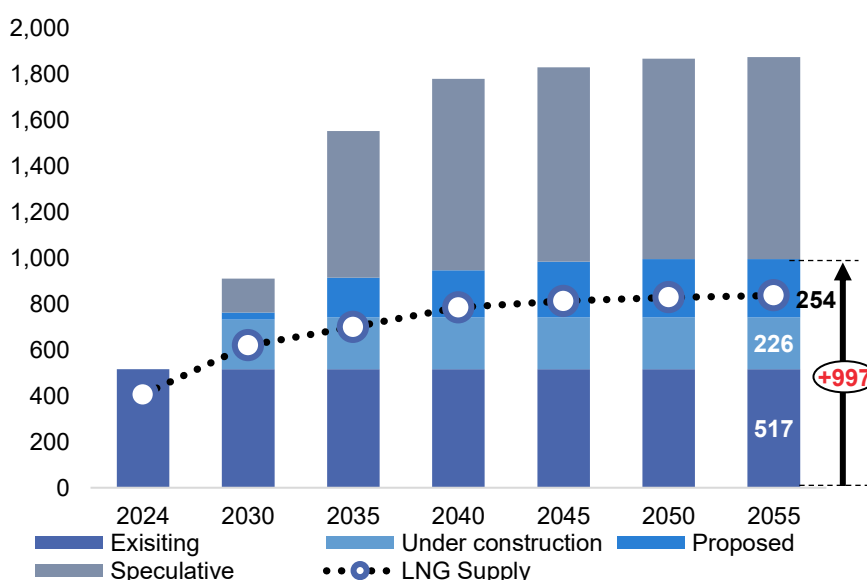
1. Introduction: why project status matters for cost formation

LNG liquefaction represents a critical midstream bottleneck in the global gas value chain, linking upstream resource availability with both international and domestic LNG markets. As one of the most capital-intensive segments of the industry, its cost structure plays a decisive role in shaping supply competitiveness and the economics of global LNG trade. At the current stage of market development, this analysis is particularly important, as the industry is transitioning from a period dominated by relatively low-cost, standardised projects to one increasingly reliant on higher-cost and more complex developments.

This shift raises fundamental questions about the cost of incremental supply, the sustainability of future LNG expansion, and the ability of the market to balance demand growth with timely investment. Against the backdrop of rising capital costs, increasing technical complexity, environmental pressures and growing uncertainty in project delivery, understanding how liquefaction costs evolve across project stages provides critical insight into future supply dynamics, price formation, and market stability.

This analysis distinguishes between three categories of projects: existing (operational), under construction, and proposed (pre-FID). This segmentation provides a structured lens through which to assess how liquefaction costs evolve across the project lifecycle and how these changes influence the marginal cost of future LNG supply. Beyond measuring cost differentials, the analysis also seeks to explain the underlying drivers of this evolution, including the interplay between technological improvements and rising structural cost pressures.

Figure 1. Projected global LNG exports (Mt) and LNG liquefaction capacity (Mtpa), 2024-2055



Source: GECF Secretariat, based on data from GECF GGM

While innovations such as modularisation, standardisation, and improved process efficiency are expected to reduce costs, these gains are increasingly offset by higher capital intensity, more complex project environments, tighter contractor capacity, and rising execution risks. As a result, the objective is not only to quantify cost differences across project stages, but also to understand why costs are rising despite technological

progress, and how these dynamics shape future supply competitiveness, investment decisions, and market balance.

The scale and composition of liquefaction capacity across project stages are illustrated in Figure 1. Global LNG exports are projected to rise from 406 Mt in 2024 to 837 Mt by 2055, with demand reaching around 700 Mt by 2035 and 785 Mt by 2040. Over this period, exports are expected to progressively align with the combined capacity of existing and under-construction projects by the mid-2030s and exceed it thereafter, highlighting the increasing reliance on proposed capacity to meet incremental demand.

At the same time, this apparent medium-term adequacy masks an emerging structural imbalance. Although total liquefaction capacity could approach 1,000 Mtpa by 2055 - exceeding projected supply - market balance will depend not only on the volume of installed capacity but on the timely development and realisation of new projects. As the contribution of planned capacity becomes more prominent over time, continued project sanctioning will be essential to sustain supply growth and maintain equilibrium in the LNG markets.

Within this evolving landscape, differences in cost structures across project stages become particularly relevant. Existing, under-construction, and planned capacities are not only distinct in terms of timing and development status, but also in their underlying economics. Understanding these differences is essential for assessing how the global LNG cost base is changing and how future supply competitiveness will be determined.

2. Analytical framework and data definition

Liquefaction costs are evaluated using a levelized framework that captures the full lifecycle economics of LNG projects. This includes both capital expenditure (CAPEX), typically expressed per unit of installed capacity, and operational expenditure (OPEX), with all costs converted into a common metric of USD/MMBtu for comparability. This approach reflects the long-run marginal cost (LRMC) of liquefaction, providing a consistent estimate of the break-even cost required to bring new supply to market.

To ensure comparability, costs are normalised using capacity-weighted averages, allowing larger projects to proportionally influence aggregate results. Cost estimates are expressed in real terms, with inflation and financing effects normalised, ensuring comparability across projects. Differences therefore reflect underlying project economics - such as capital intensity, technology, and execution conditions - rather than nominal market fluctuations at the time of development.

The analysis includes both greenfield and brownfield projects, recognising that brownfield expansions - while still accounting for full CAPEX and OPEX in levelized cost terms - typically benefit from existing infrastructure, utilities, and site integration, resulting in lower unit costs. In contrast, greenfield developments face higher capital intensity and execution risk, leading to higher overall cost structures. Differences between onshore and offshore (FLNG) projects are not treated as separate categories but are reflected in the dispersion of costs, capturing variations in both CAPEX (driven by technical complexity and location) and OPEX (linked to operating conditions and design).

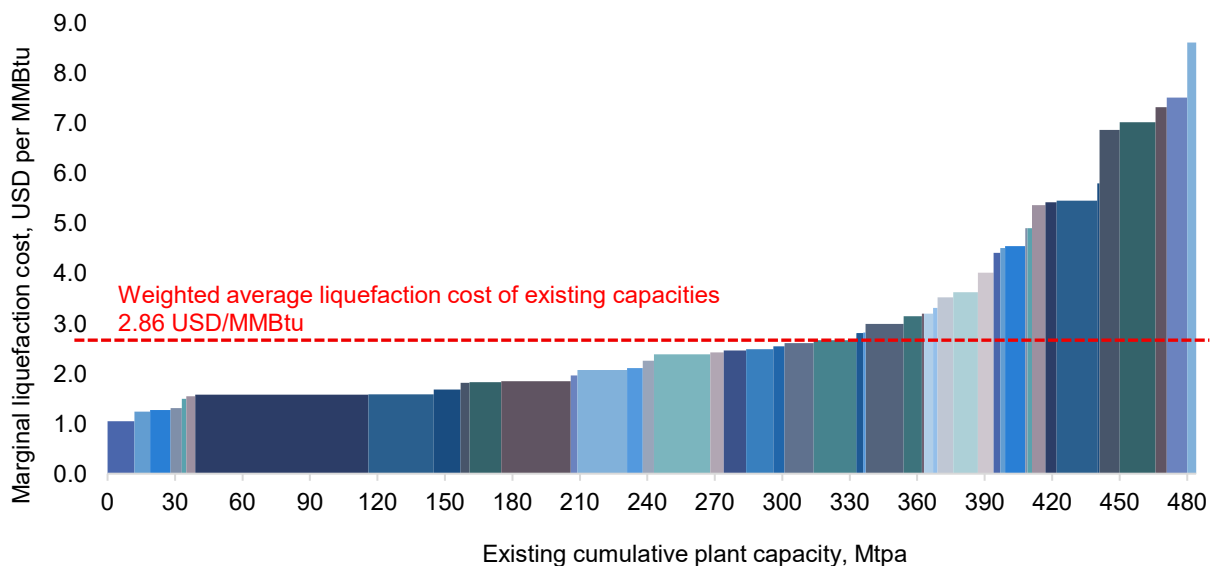
Project status - classified as existing, under construction, and proposed (pre-FID) - is used as the central analytical dimension. This segmentation is economically meaningful, as it captures systematic differences in cost drivers across the project lifecycle, including technology selection, geographical conditions, execution risk, and timing of investment. It

also reflects the transition from historically optimised, lower-cost assets to more complex and project-specific developments that increasingly define the marginal cost of future LNG supply.

3. Cost profile of existing liquefaction capacities

Existing liquefaction capacity provides the baseline for global LNG supply economics, reflecting a historically lower-cost environment shaped by favourable investment conditions, mature technologies, and optimised infrastructure. Based on the dataset, the capacity-weighted average liquefaction cost is estimated at around 2.86 USD/MMBtu, with an average plant size of approximately 10.3 Mtpa. The cost distribution is relatively concentrated, with most projects falling within a range of roughly 1.0 to 3.5 USD/MMBtu, although a limited number of higher-cost outliers extend the upper bound to above 8 USD/MMBtu, particularly in technically complex or offshore developments (Figure 2).

Figure 2. Global LNG liquefaction cost curve – existing projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

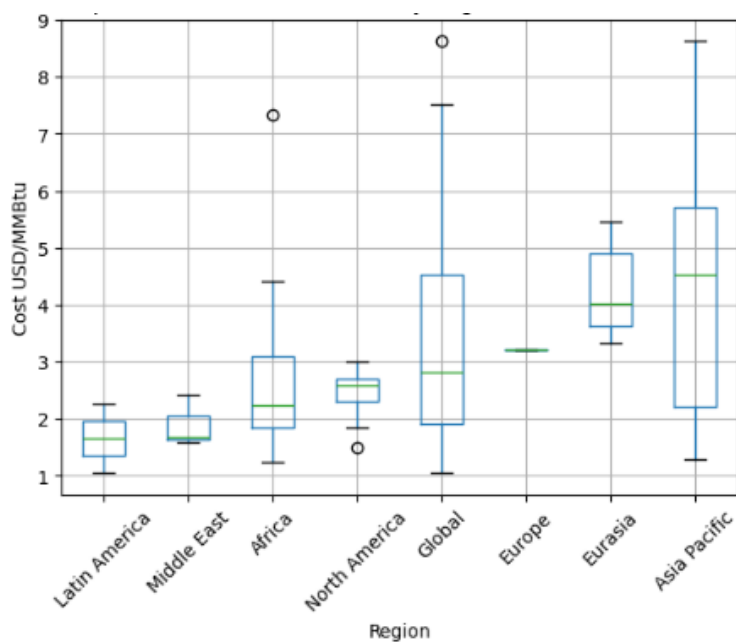
This relatively tight cost distribution reflects the legacy advantages embedded in existing capacity. Many operational projects benefited from lower capital costs, favourable EPC conditions, and the widespread deployment of standardised large-scale onshore liquefaction technologies, particularly mixed refrigerant processes such as APCI C3MR. In addition, a significant share of capacity has been developed through incremental upgrades, allowing projects to leverage existing infrastructure, utilities, and logistics systems, thereby reducing unit costs. These factors collectively contribute to a cost structure that is difficult to replicate under current market conditions.

Regional cost patterns show a clear progression from low and tightly clustered costs to higher and more dispersed structures. Latin America and the Middle East (medians 1.66 and 1.68 USD/MMBtu respectively) exhibit very low dispersion, reflecting mature, large-scale onshore projects, strong infrastructure, and standardized technologies. Africa (2.24) and North America (2.56) move into a moderate dispersion range, where a competitive

core coexists with some higher-cost projects, driven by a mix of project types (including modular and offshore elements) and varying development conditions.

At the higher end, dispersion becomes more pronounced. The global distribution (2.81) shows a wide spread, capturing both low-cost legacy assets and higher-cost developments. Europe (3.2) remains relatively tight but structurally higher-cost, while Eurasia (4.02) displays broader dispersion, reflecting more complex and frontier-type projects. Asia Pacific (4.53) shows the widest dispersion, with a long upper tail driven by remote locations, offshore/FLNG developments, and high capital intensity (Figure 3).

Figure 3. Liquefaction cost distribution by region and global - existing projects (USD/MMBtu)

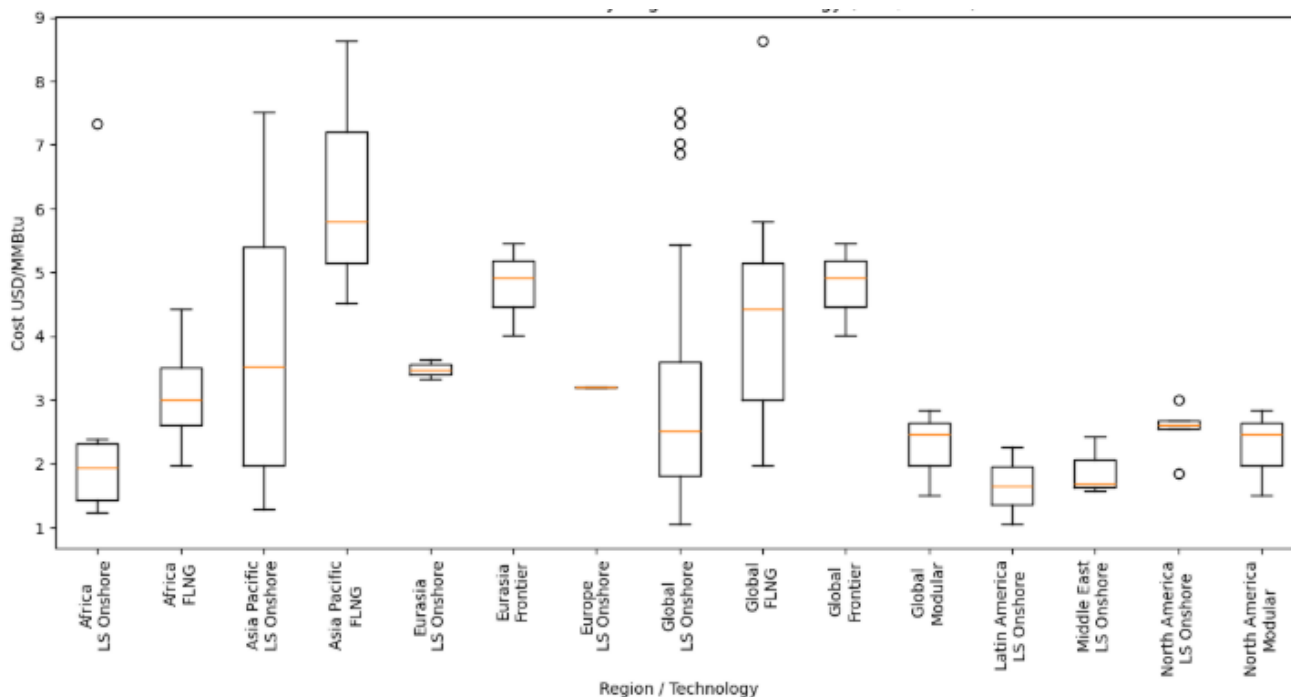


Source: GECF Secretariat, based on data from GECF GGM

Technology also plays a key role in shaping cost outcomes. Large-scale onshore LNG remains the backbone of competitiveness across all regions, with a global median around 2.7 USD/MMBtu, supported by economies of scale and mature technologies. Modular LNG emerges as a promising alternative, particularly in North America, with costs around 2.5 USD/MMBtu, benefiting from standardisation and lower execution risk. At the regional level, the Middle East leads in cost competitiveness, followed closely by North America, both leveraging favourable resource bases, infrastructure, and established project models.

At the same time, costs rise sharply with increasing technical complexity. FLNG represents the most expensive segment, with global median costs around 5 USD/MMBtu and up to 5.7 USD/MMBtu in Asia Pacific, reflecting offshore and remote development challenges; its deployment is concentrated in Africa and Asia Pacific, where infrastructure constraints necessitate such solutions. In parallel, frontier LNG projects in Eurasia (Russia) exhibit similarly elevated costs (around 4.9-5 USD/MMBtu), driven by specialised technologies required for harsh Arctic conditions. Overall, while existing capacity reflects a competitive and standardised legacy cost base, the growing role of FLNG and frontier developments is pushing the upper end of the cost curve higher, increasing the heterogeneity of future LNG supply (Figure 4).

Figure 4. Liquefaction cost distribution by region and technology¹ - existing projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

4. Cost profile of under-construction liquefaction capacities

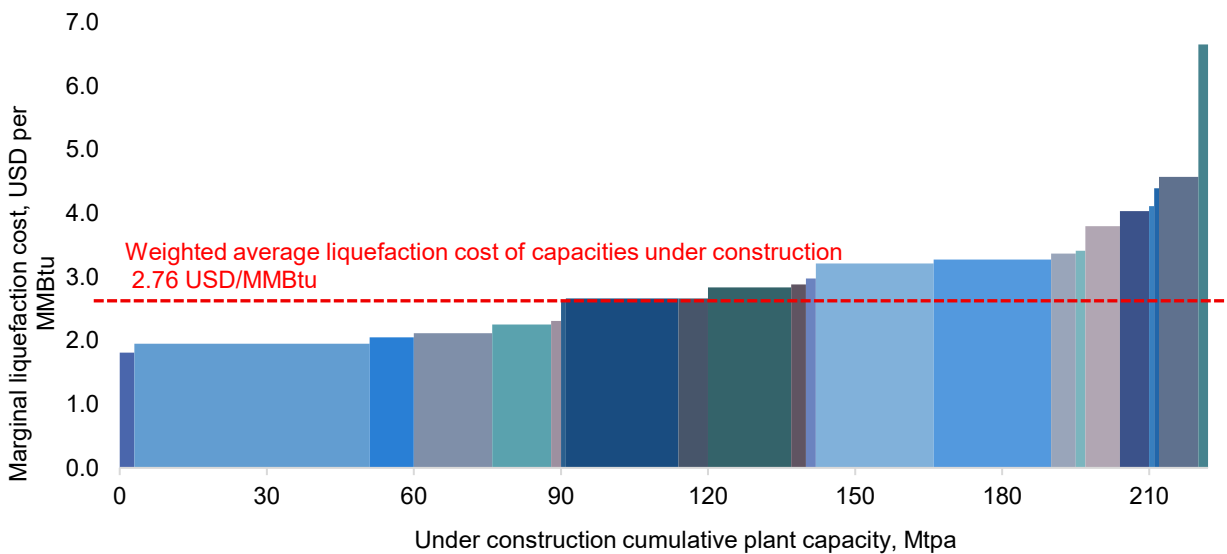
Under-construction liquefaction capacity reflects the ongoing transition in LNG supply economics, capturing projects sanctioned under evolving market conditions, including rising costs and increasing project complexity. Based on the dataset, the capacity-weighted average liquefaction cost is estimated at around 2.76 USD/MMBtu, broadly comparable to existing capacity, but already exhibiting signs of greater dispersion and structural change. While most projects remain concentrated within a range of approximately 2.0 to 4.0 USD/MMBtu, the upper bound extends above 6 USD/MMBtu, indicating the emergence of higher-cost marginal supply (Figure 5).

Regional cost patterns reveal a more heterogeneous and dispersed structure compared to existing capacity. The Middle East remains the most competitive region, with median costs around 2.05 USD/MMBtu, supported by large-scale onshore developments and favourable upstream conditions. North America follows, with median costs around 2.66 USD/MMBtu, but with a noticeably wider dispersion reflecting the coexistence of large-scale, modular, and higher-cost projects. Latin America appears competitive, although based on a limited number of developments.

Rising Marginal Costs in LNG Liquefaction: Implications for Global Gas Trade, Investment and Market Stability | Expert Commentary

¹ LS Onshore - large-scale onshore liquefaction technology; FLNG - floating liquefied natural gas technology; Frontier LNG - technologies deployed in extreme or technically challenging environments; Modular LNG - standardised, small- to mid-scale liquefaction technology (see Definitions at the end of the Expert Commentary for further details).

Figure 5. Global LNG liquefaction cost curve – under construction projects (USD/MMBtu)

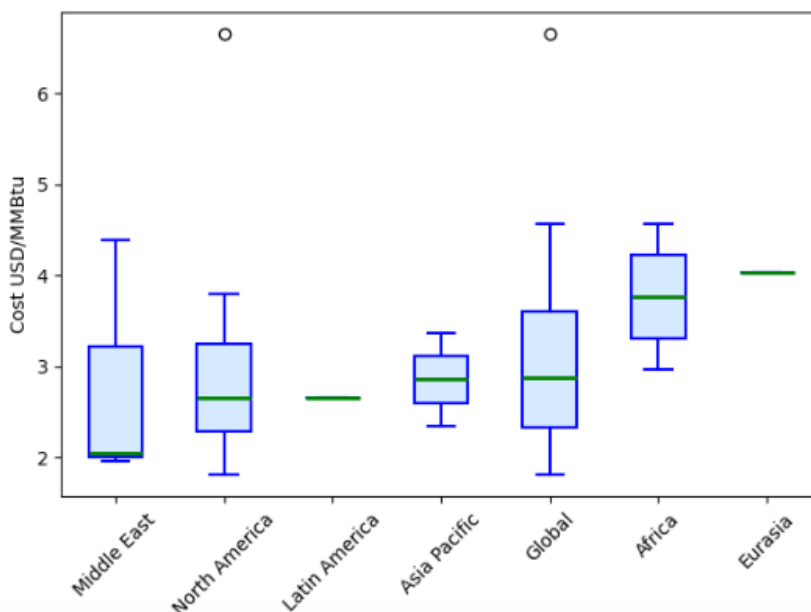


Source: GECF Secretariat, based on data from GECF GGM

At the same time, costs increase across more complex regions. Asia Pacific shifts toward higher-cost structures, reflecting more challenging project environments and capital intensity. Africa exhibits significant dispersion, driven by the growing role of FLNG and project-specific conditions.

Eurasia remains at the upper end of the cost curve, with frontier projects around 4.0 USD/MMBtu, reflecting harsh climatic conditions, infrastructure constraints, and specialised technological requirements. The global distribution (2.9 USD/MMBtu) captures this widening dispersion, highlighting a shift toward a more heterogeneous cost base (Figure 6).

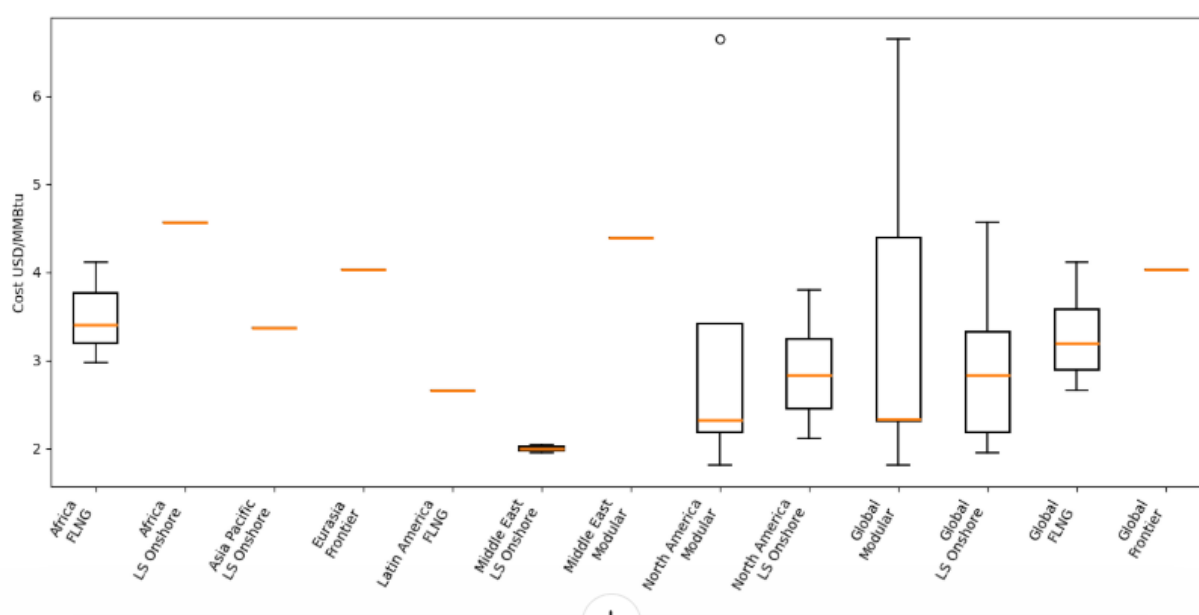
Figure 6. Liquefaction cost distribution by region and global - under construction projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

Technology continues to play a central role in shaping cost outcomes. The regional-technology breakdown for under-construction projects highlights a more nuanced and evolving cost hierarchy compared to existing capacity. While large-scale onshore LNG remains the structural anchor, particularly in the Middle East with a median cost of 2.05 USD/MMBtu, the gap with alternative technologies is narrowing. Notably, modular LNG in North America shows a median of around 2.31 USD/MMBtu, positioning it very close to the core cost range of onshore projects (2.66 USD/MMBtu). This reflects the growing role of standardisation and execution efficiency, making modular solutions increasingly competitive within the lower-cost segment of the supply curve.

Figure 7. Liquefaction cost distribution by region and technology² - under construction projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

At the same time, FLNG appears more competitive than in the existing fleet, with median costs around 2.66 USD/MMBtu in Latin America and 3.41 USD/MMBtu in Africa, significantly below the 5 USD/MMBtu levels observed for existing projects. This suggests that technological improvements and project optimisation are reducing the offshore cost premium, particularly for smaller-scale or infrastructure-constrained developments. However, dispersion remains significant, with certain segments - particularly large-scale onshore projects in Africa and frontier developments in Eurasia - continuing to occupy the higher end of the cost curve, reflecting persistent cost pressures in more complex and challenging environments. Overall, the under-construction portfolio points to a partial flattening of the cost hierarchy at the lower end, while maintaining a clearly defined high-cost tail, resulting in a supply landscape that is both more competitive and increasingly heterogeneous (Figure 7).

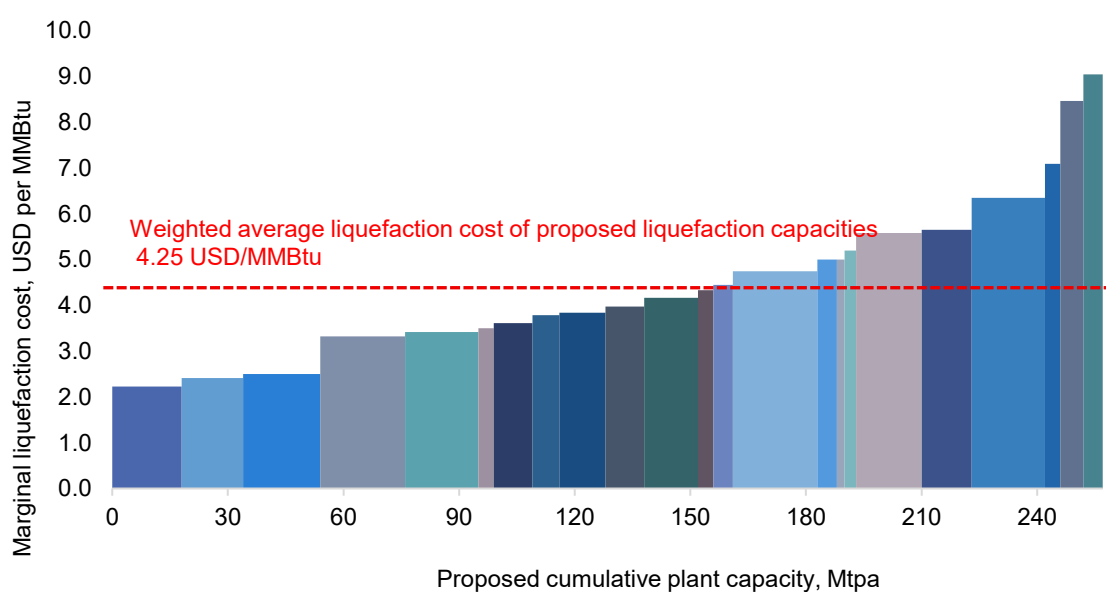
Rising Marginal Costs in LNG Liquefaction: Implications for Global Gas Trade, Investment and Market Stability | Expert Commentary

² LS Onshore - large-scale onshore liquefaction technology; FLNG - floating liquefied natural gas technology; Frontier LNG - technologies deployed in extreme or technically challenging environments; Modular LNG - standardised, small- to mid-scale liquefaction technology (see Definitions at the end of the Expert Commentary for further details).

5. Cost profile of proposed projects: the emerging cost frontier

Existing and under-construction projects, developed under more favourable cost environments, cluster within a relatively narrow cost range. In contrast, proposed projects - representing the next tranche of supply - are significantly more expensive. This widening gap is not cyclical but structural, reflecting the depletion of lower-cost opportunities, rising project complexity, increasing engineering and construction costs, and expansion into more challenging environments, including remote, offshore, and high-risk regions.

Figure 8. Global LNG liquefaction cost curve – proposed projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

Proposed liquefaction capacity represents the next phase of LNG supply development, reflecting a clear structural shift toward higher-cost and more complex projects. However, given that these projects have not yet reached final investment decision, cost estimates remain subject to a higher degree of uncertainty, as project configurations, financing terms, and execution conditions are not fully defined. Based on the dataset, the capacity-weighted average liquefaction cost is estimated at around 4.25 USD/MMBtu, significantly above both existing and under-construction levels. This marks a decisive transition in LNG cost dynamics, where new supply increasingly relies on higher-cost marginal resources. While a portion of projects remains within a competitive range of approximately 3.0 to 5.0 USD/MMBtu, the upper bound extends beyond 9 USD/MMBtu, indicating a substantial expansion of the high-cost segment (Figure 8).

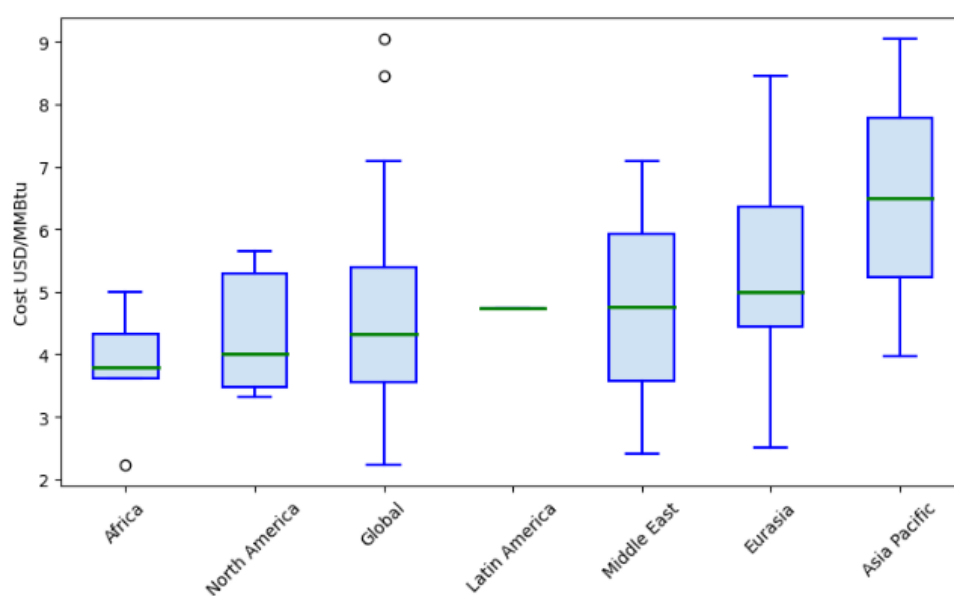
Regional cost patterns highlight a marked increase in dispersion and heterogeneity, reflecting the broader structural transformation of the LNG supply base. Africa and North America continue to form part of the relatively competitive core, with median costs around 3.8-4.0 USD/MMBtu, supported by a mix of large-scale onshore and selected floating developments. However, dispersion within these regions is widening, indicating increasing variability in project economics.

The Middle East retains its position as the lowest-cost region in capacity terms, with a weighted median of around 2.41 USD/MMBtu, although the inclusion of more complex

expansions introduces a wider cost range. Latin America remains relatively concentrated, with limited project representation and median costs around 4.7 USD/MMBtu.

In contrast, Asia Pacific and Eurasia are positioned firmly at the higher end of the cost spectrum. Asia Pacific exhibits the widest dispersion, with median costs exceeding 6.5 USD/MMBtu and a pronounced upper tail driven by high-cost projects. Eurasia also reflects a structurally higher-cost profile, with frontier developments pushing costs toward 5.0 USD/MMBtu and above, driven by challenging climatic conditions, infrastructure constraints, and specialised technological requirements. The global distribution, with a median around 4.3 USD/MMBtu, captures this increasing dispersion and upward shift in costs (Figure 9).

Figure 9. Liquefaction cost distribution by region and global - proposed projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

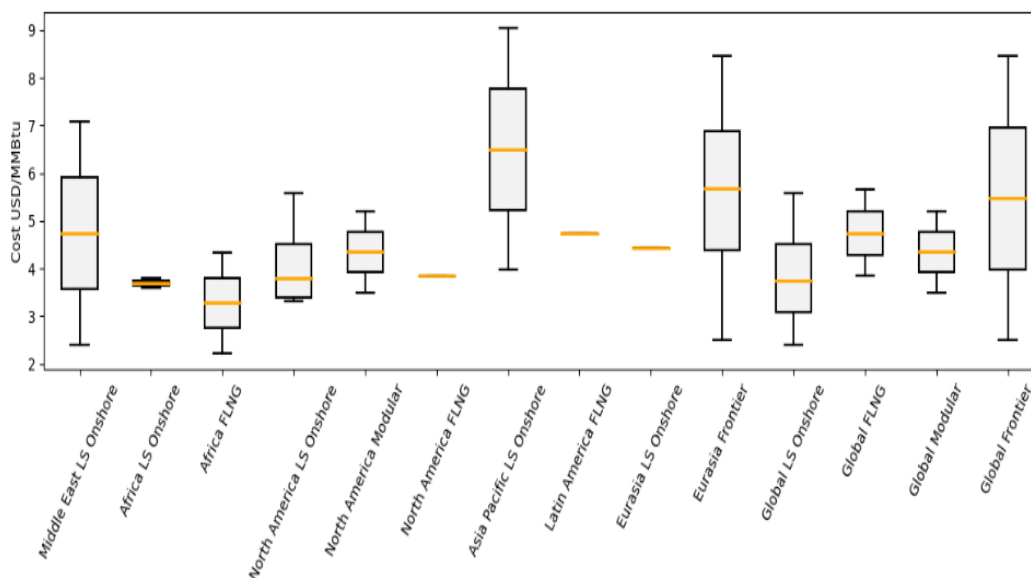
Technology plays an increasingly decisive role in shaping cost outcomes, with a more pronounced stratification emerging compared to earlier project phases. Large-scale onshore LNG remains the structural backbone of supply, particularly in the Middle East, where it anchors the lower end of the cost curve. However, unlike under-construction projects, the cost advantage of this segment is becoming more differentiated across regions, reflecting variations in upstream conditions, infrastructure availability, and project execution.

Modular LNG continues to demonstrate competitive positioning in North America, with median costs around 4.3 USD/MMBtu, although it no longer occupies the lower end of the cost curve. FLNG exhibits a wide range of outcomes, with relatively competitive costs in Africa (3.3 USD/MMBtu) but higher dispersion globally, reflecting project-specific characteristics and offshore complexity.

At the same time, frontier LNG developments emerge as the defining feature of the proposed portfolio, particularly in Eurasia, where median costs exceed 5.5 USD/MMBtu and extend significantly higher. These projects reflect a shift toward technically challenging environments, including Arctic and remote developments, where cost structures are inherently elevated. Overall, the technology-based distribution highlights a

clear widening of the cost hierarchy, with a competitive core increasingly separated from a high-cost frontier segment (Figure 10).

Figure 10. Liquefaction cost distribution by region and technology³ - proposed projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

The proposed LNG project pipeline highlights a clear structural shift toward a higher and more dispersed cost base, where a relatively competitive core coexists with an expanding high-cost frontier driven by increasing project complexity and more challenging development environments. This reflects a rising marginal cost of supply and a widening gap between low- and high-cost projects across regions and technologies. As a result, while LNG resources remain abundant, future supply growth is increasingly constrained by economic viability rather than availability, with cost competitiveness, execution risks, and investment selectivity becoming the key determinants of project development.

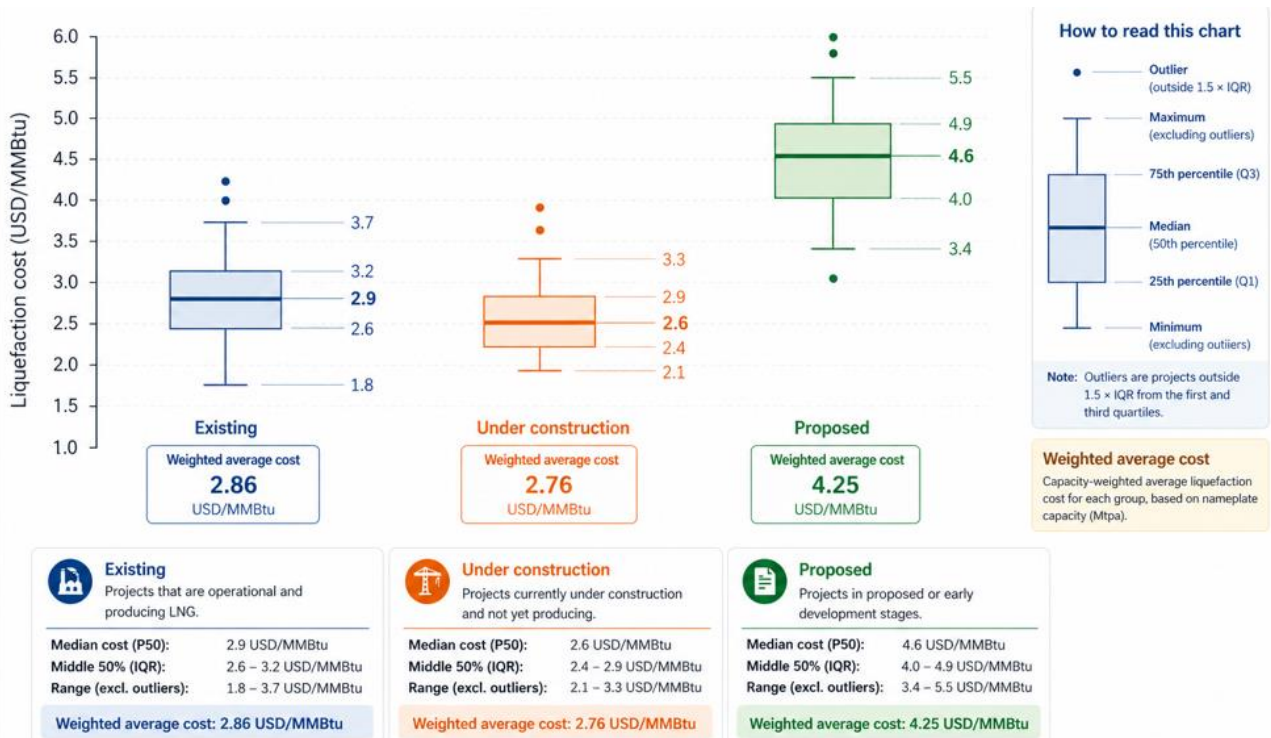
6. Cross-segment comparison: structural shifts in cost dynamics

A cross-segment comparison of LNG project costs reveals a clear structural shift in both cost levels and dispersion across development stages (Figure 11). Existing and under-construction projects remain relatively tightly clustered, reflecting stable cost structures and limited variability. In contrast, proposed projects shift to higher cost levels and display a markedly wider distribution, with elevated medians and broader interquartile ranges. This indicates increasing heterogeneity in project economics, driven by rising capital and financing costs, greater technical complexity, and more diverse project conditions. Overall, the widening cost distribution highlights growing uncertainty and a diminishing share of low-cost opportunities, with future supply increasingly concentrated in higher-cost segments.

Rising Marginal Costs in LNG Liquefaction: Implications for Global Gas Trade, Investment and Market Stability | Expert Commentary

³ LS Onshore - large-scale onshore liquefaction technology; FLNG - floating liquefied natural gas technology; Frontier LNG - technologies deployed in extreme or technically challenging environments; Modular LNG - standardised, small- to mid-scale liquefaction technology (see Definitions at the end of the Expert Commentary for further details).

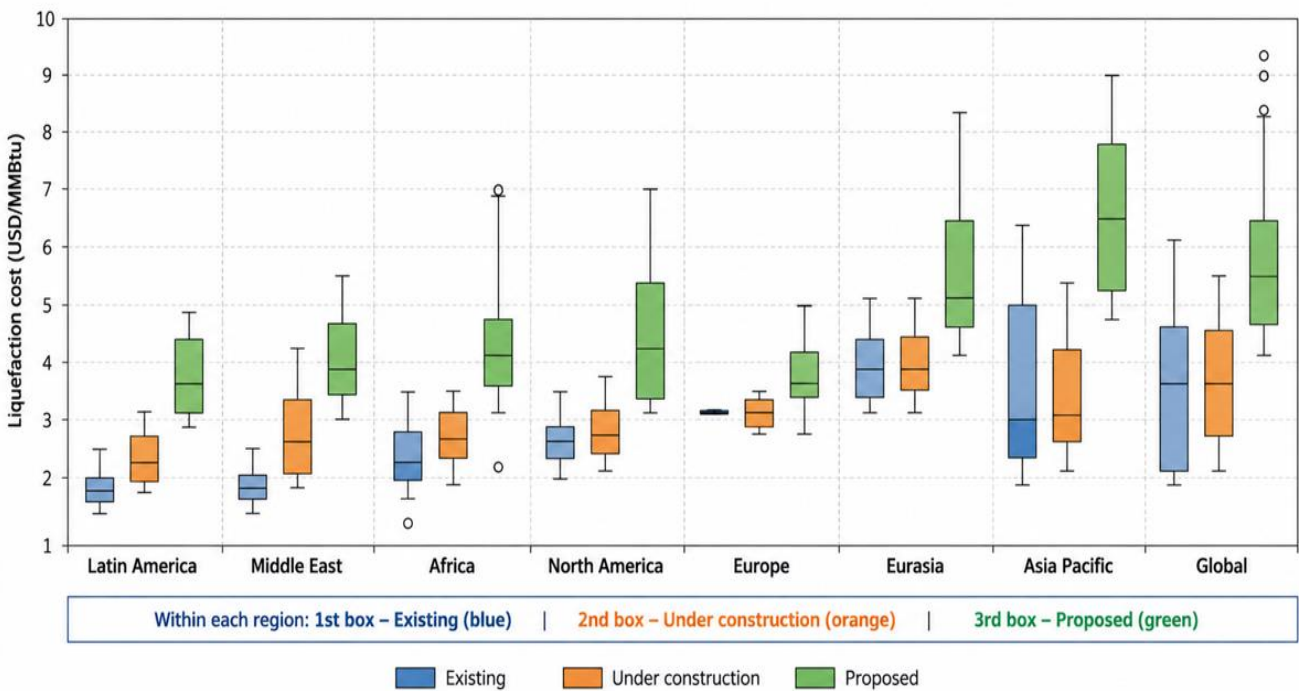
Figure 11. Global LNG liquefaction cost distribution – existing, under construction and proposed projects (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

Building on this, the regional comparison helps explain how this dispersion is distributed geographically. The Middle East remains the structural cost anchor, maintaining the lowest cost levels across all stages despite some upward shift in proposed projects, while Asia Pacific and Eurasia emerge as the high-cost frontier, reflecting the strongest cost escalation linked to complexity and challenging environments.

Figure 12. Liquefaction cost distribution by region and project status (USD/MMBtu)



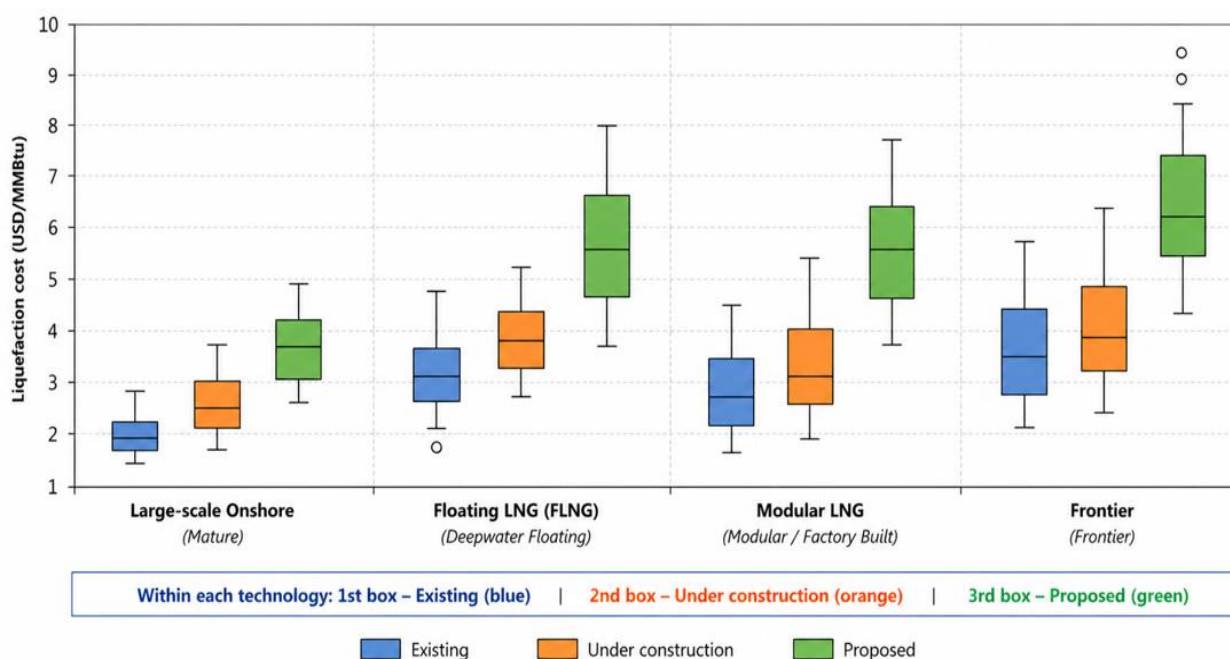
Source: GECF Secretariat, based on data from GECF GGM

At the same time, Africa and North America form a competitive but increasingly dispersed core, where costs remain moderate but variability is rising due to a broader mix of technologies and project conditions (Figure 12).

The technology-based comparison highlights how cost dynamics evolve across project stages. Large-scale onshore LNG remains the structural cost anchor, maintaining the lowest and most stable cost profile, although shifting upward in the proposed segment. FLNG and modular LNG contribute to increasing dispersion, with costs becoming more variable as projects move from existing to under-construction and proposed stages.

At the same time, frontier LNG developments define the high-cost segment, with the most pronounced escalation and widest spread in proposed projects, reflecting greater technical complexity and execution risks. Overall, the interaction between project stage and technology underscores a more stratified and heterogeneous cost landscape, where both cost levels and variability increase as the industry moves toward the next tranche of supply (Figure 13).

Figure 13. Liquefaction cost distribution by technology and project status (USD/MMBtu)



Source: GECF Secretariat, based on data from GECF GGM

The structural increase and widening dispersion in liquefaction costs translate directly into a more competitive and stratified LNG supply landscape. Existing and under-construction projects, developed under more favourable cost conditions, retain a strong competitive advantage, forming the low-cost core of global supply, while proposed projects represent a higher-cost tier that is increasingly exposed to market conditions. As a result, the global LNG supply curve is steepening, with a clearer separation between competitive and marginal projects.

This implies a greater sensitivity of supply to price signals, where only projects within the competitive cost range are likely to proceed under moderate price environments, while higher-cost developments require sustained price support or favourable commercial conditions. In this context, cost escalation becomes a key determinant of market entry, with a growing risk that a portion of the proposed pipeline may remain delayed or

unmaterialised. Overall, LNG supply growth is becoming increasingly selective and price-dependent, with cost competitiveness, execution risk, and financing conditions shaping which projects advance and which remain stranded.

The comparison confirms a clear structural shift in LNG costs, with proposed projects introducing a step-change to a higher and more dispersed cost base. While existing and under-construction capacity remains relatively stable, future supply is increasingly driven by more complex and higher-cost projects, with dispersion widening across technologies. Overall, LNG supply is becoming more cost-sensitive and risk-driven, with a higher marginal cost defining the next phase of market development.

7. Investment and market Implications

7.1 Investment cycles, timing, and market balance

Despite significant planned capacity additions, the balance of the LNG market depends critically on the timing and continuity of investment, increasingly shaped by cost differences across project stages. Existing and under-construction projects - characterised by relatively lower and more stable costs - form the backbone of near-term supply, reflecting earlier investment cycles and more favorable cost conditions. In contrast, proposed projects represent the next wave of supply but are associated with higher costs and greater uncertainty. While the capacity additions expected between 2025 and 2030 may temporarily ease market conditions, lower prices during such periods can weaken incentives to advance these higher-cost projects toward final investment decision.

Given the typical four- to five-year lag between FID and start-up, delays in sanctioning proposed projects can translate directly into supply constraints later in the outlook period. This creates the risk of recurring investment cycles, where short-term market softness leads to underinvestment in higher-cost future supply, followed by tighter market conditions as demand continues to grow. Ensuring market balance will therefore depend not only on the volume of planned capacity, but on sustained investment in progressively higher-cost projects required to meet future demand.

7.2 Rising structural price floor

The upward shift in marginal liquefaction costs is raising the structural price floor of the LNG market. As new supply increasingly depends on higher-cost projects, prices must settle at levels sufficient to support investment, particularly during periods of demand growth. While short-term volatility will persist, long-term pricing is becoming more anchored in project economics, with marginal cost playing a growing role in price formation. As a result, LNG markets are likely to operate within a structurally higher price range than in the past.

7.3 Reduced supply elasticity and increased volatility

The increasing scale, complexity, and capital intensity of LNG projects are reducing supply responsiveness. With development timelines spanning several years, supply cannot adjust quickly to short-term market signals, limiting flexibility and amplifying imbalances. At the same time, deeper integration of global gas markets through LNG trade is accelerating the transmission of disruptions across regions, contributing to heightened volatility even in otherwise well-supplied conditions.

7.4 Reinforced role of long-term contracts

Higher-cost liquefaction projects are reinforcing the strategic importance of long-term contracts in underpinning investment. Developers require stable and predictable revenue streams to secure financing, making long-term sales agreements essential for project viability. At the same time, contractual structures are evolving toward hybrid models that combine long-term security with greater flexibility, allowing markets to balance investment needs with operational adaptability.

Rising liquefaction costs, combined with widening cost differentials across project stages, are reshaping LNG markets into a more capital-intensive and investment-driven system. Higher-cost proposed projects are setting a new marginal cost frontier, raising the structural price floor, while the scale and complexity of developments are reducing supply responsiveness and amplifying market volatility. At the same time, these conditions are reinforcing the central role of long-term contracts in securing investment, alongside a gradual shift toward more flexible contractual arrangements. In this context, ensuring market stability will depend on the timely sanctioning of new projects and the ability to balance investment certainty with sufficient flexibility to respond to evolving market conditions.

8. Conclusion

The analysis confirms a structural shift in LNG liquefaction costs, moving from a relatively stable, low-cost base toward a higher and more complex cost environment. Existing and under-construction projects continue to anchor supply with moderate costs, while proposed projects introduce a clear step-change, reflecting rising capital intensity and technical complexity. **As a result, the global LNG supply curve is steepening, with a sharper distinction between competitive core supply and higher-cost marginal projects.**

A second key outcome is the widening dispersion of costs across project stages, regions, and technologies. The Middle East remains the cost anchor, while Asia Pacific and Eurasia define the high-cost frontier, and Africa and North America form a competitive but increasingly heterogeneous core. Across technologies, large-scale onshore LNG maintains its cost advantage, while FLNG, modular, and frontier projects contribute to growing variability. **This increasing dispersion highlights a more stratified and uncertain supply landscape.**

Third, LNG market dynamics are increasingly shaped by the rising cost of new supply. The shift toward higher-cost projects is lifting the structural price floor, reducing supply responsiveness, and amplifying volatility. With fewer low-cost options available to balance the market, **prices are becoming more sensitive to supply-demand imbalances and are increasingly anchored to the economics of new project development** rather than the cost of existing capacity.

Finally, investment emerges as the critical determinant of future market balance. The ability to meet growing demand will depend on timely and sustained investment in higher-cost projects, supported by adequate price signals, financing conditions, and contractual frameworks. Delays in project sanctioning risk creating future supply constraints, reinforcing the importance of balancing investment certainty with sufficient flexibility in an increasingly complex and cost-driven LNG market. **Timely investment in higher-cost projects will ultimately determine supply adequacy and market stability.**

References

1. Gas Exporting Countries Forum (GECF) (2025). *Global Gas Outlook, 9th edition*. Doha: GECF. Available at: www.gecf.org
2. Gas Exporting Countries Forum (GECF) (2026). *Global Gas Outlook, 10th edition*. Doha: GECF. Available at: www.gecf.org
3. International Energy Agency (IEA) (2026). *Global LNG Capacity Tracker*. Available at: www.iea.org
4. International Energy Agency (IEA) (2025). *World Energy Outlook 2025*. Paris: IEA. Available at: www.iea.org
5. International Group of Liquefied Natural Gas Importers (GIIGNL) (2025). *Annual LNG Report 2025*. Available at: www.giignl.org
6. International Gas Union (IGU) (2025). *World LNG Report 2025*. Available at: www.igu.org
7. Rystad Energy (2025-2026). *Upstream and LNG Market Outlook*. Available at: www.rystadenergy.com

Definitions

Liquefaction technology classification:

1. LS Onshore - Large-Scale Onshore LNG

Refers to conventional, land-based liquefaction facilities with high-capacity trains (typically 4–8+ mtpa per train), using mature technologies such as APCI C3MR, AP-X, or Optimized Cascade. These projects benefit from economies of scale, integrated infrastructure, and established supply chains, making them the most cost-efficient segment of global LNG supply.

Examples: QatarEnergy LNG (Qatar), Sabine Pass LNG (USA), North West Shelf LNG (Australia)

2. FLNG - Floating LNG

Refers to offshore liquefaction facilities installed on floating vessels, designed to process and liquefy gas directly at sea. FLNG is typically deployed in remote offshore fields where onshore infrastructure is not viable. While offering flexibility and faster deployment in certain contexts, FLNG involves higher costs due to technical complexity, space constraints, and offshore operating conditions.

Examples: Prelude FLNG (Australia), Coral South FLNG (Mozambique), PFLNG (Malaysia)

3. Modular LNG (Mid-/Small-Scale LNG)

Refers to standardised, prefabricated liquefaction units, often smaller in scale, assembled in modules and deployed rapidly. These projects emphasise simplified design, shorter construction timelines, and lower execution risk, making them increasingly attractive in competitive markets.

Examples: Calcasieu Pass LNG (USA), Fast LNG Altamira (Mexico), Elba Island LNG (USA)

4. Frontier LNG

Refers to liquefaction projects developed in extreme or technically challenging environments, such as the Arctic or regions with limited infrastructure. These projects require specialised engineering solutions, including adapted liquefaction processes, gravity-based structures, or ice-resistant designs. As a result, they are typically associated with high capital intensity and elevated costs.

Examples: Yamal LNG (Russia), Arctic LNG 2 (Russia)