



# LNG Carrier :

The Floating Pipeline Powering Global Gas Expansion - Unveiling its Hidden Enablers

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## LNG Carrier: The Floating Pipeline Powering Global Gas Expansion - Unveiling its Hidden Enablers

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# 1 Executive Summary

The past decade marked a 'Golden Age' for LNG, fueled by rising Asian gas demand, surging U.S. LNG exports, and geopolitical shifts in Europe. LNG trading volumes have surpassed traditional pipeline gas, with LNG carrier fleets expanding threefold from 325 units in 2014 to 970 units in 2023.

This report by Solutions For Our Climate (SFOC) reveals the key yet overlooked industries behind this rapid expansion of the LNG shipping market, compared to other more prominent parts of the fossil gas value chain.

Key findings of the research underscore the **significant financial contributions from South Korea's public financiers, totaling \$47 billion across 679 cases in LNG carrier shipbuilding over the past decade (2013-2023)**. Notably, this report also emphasizes a pivotal shift in LNG carrier ownership, with **private equity-linked entities and traditional shipowners driving shipbuilding orders over the last decade**, while energy majors have decreased their involvement.

The findings highlight imminent risks, with LNG carrier fleets on order projected to exceed estimates by the International Energy Agency (IEA), potentially jeopardizing global climate targets. To address these concerns, the report recommends urgent actions to the following stakeholders:

## 1. Financiers:

- Public & Private financiers halt financing for new LNG carriers.
- Investors to engage LNG shipping players with exclusion criteria for the industry.

## 2. Shipowners:

- Stop exposing themselves to the increasingly precarious LNG shipping market.
- Align portfolios of vessels to the Paris-aligned trajectory.

## 3. Shipyards:

- Korea & China shipyards diversify into the renewable energy sector and accelerate innovative, green-fueled shipbuilding markets.

Failure to realign LNG carrier capacity with the net-zero trajectory poses severe risks to global climate targets, potentially surpassing critical tipping points scientists have warned about. By acting on these recommendations, stakeholders can mitigate these risks and contribute to a more sustainable and resilient energy future.

# 2 Current Landscape of LNG Trading and its Changing Dynamics

In this report, we begin by examining the historical trend of fossil gas trading by its flow type, and the long-term projection of the LNG trading landscape in light of climate scenarios. We then dive into the shifts in LNG demand and supply for the recent years (2021-2022) to understand the changing dynamics.

## 2.1 LNG Trading Volume Surpasses Pipeline Gas, Reaching Record High LNG Prices in 2022

Since 2011, the volume of LNG trading has almost doubled, from 324 billion cubic meters (bcm) in 2011 to 531 bcm in 2022. This growth was driven by traditional Asian importers like Japan and Korea, as well as the rapidly growing Chinese market. This LNG market expansion coincided with more supply diversification, particularly from the US, which led to shorter and more flexible LNG contracts.<sup>1</sup> The start of US LNG export in 2016, enabled by advances in shale gas extraction technologies, significantly increased LNG trading volume. Previously, LNG buyers were limited to consuming LNG for their own use, without flexibility to redirect shipments. However, with the introduction of flexible contracts from US LNG export terminals that allow reselling, LNG has become a widely traded commodity, prompting many global energy companies to set up dedicated LNG trading desks.

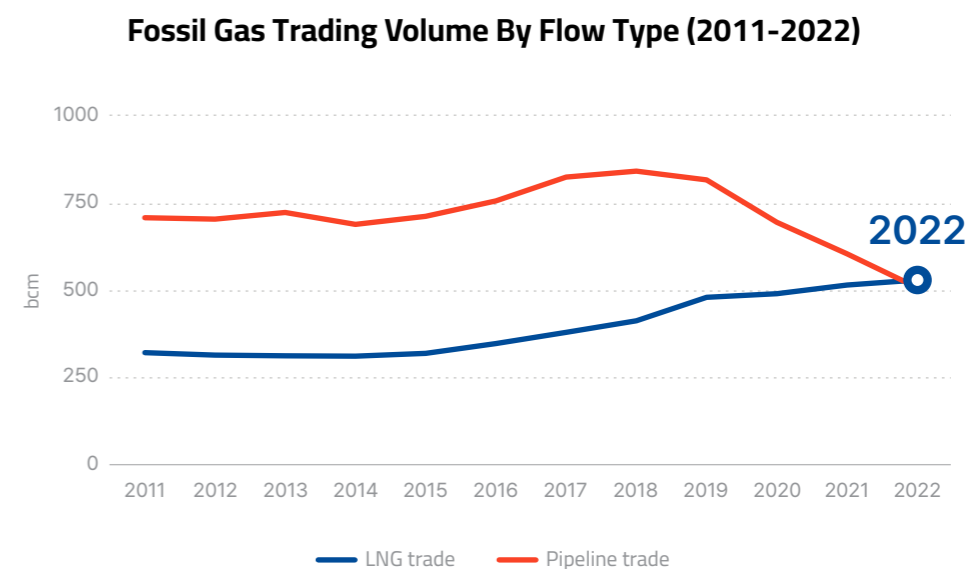


Figure 2-1 Fossil Gas Trading Volume by Flow Type (2011 - 2022)  
Source: SFOC, IGU's Global Gas Report for 2019, 2020, 2022 and 2023

<sup>1</sup> LNG Market Trends and Their Implications, IEA (2019)

Data compiled by SFOC from IGU's Global Gas Reports for 2019, 2020, 2022 and 2023 shows LNG trading volume surpassed that of piped gas in 2022 for the first time, as illustrated in Figure 2-1. According to data by CEDIGAZ, the global LNG trade volume in 2022 reached a record high, 51.7 billion cubic feet per day (bcf/d), making a 5% increase from 2021<sup>2</sup>. This surge in demand was primarily due to Russia's decision to reduce pipeline gas supply to the European Union. In reaction, EU buyers purchased an unprecedented volume of LNG and this unexpected rise in demand, coupled with the limited regasification capacity in Europe which caused huge traffic congestion around the LNG import terminals, pushed up the LNG spot price to the all-time peak of \$70.50/mmbtu in August 2022.

## 2.2 Post-Ukraine Invasion Shifts: The End of Golden Age for LNG

Following Russia's invasion of Ukraine, the energy landscape is shifting dramatically. This pivotal event, evidenced by the record-high spot LNG prices, is anticipated to redefine energy markets and policies for years to come, steering a global transition towards cleaner, secure, and affordable energy systems.<sup>3</sup>

For the first time since 2015, Asia reported a decrease in LNG imports, a 7.6% drop compared to 2021, as LNG gained a reputation as an unreliable energy source, vulnerable to sharp price hikes. Notably, China recorded a substantial decrease, with imports down by 20% y-o-y (year over year).<sup>4</sup> The Institute for Energy Economics and Financial Analysis (IEEFA) anticipates that sustained high global LNG prices, sluggish LNG demand growth, reduction in gas consumption in Europe, and a consistent investment in cost-competitive energy alternatives over the past few years will further challenge global LNG demand outlook in the upcoming years.<sup>5</sup>

Moreover, the IEA has forecasted for the first time in their 2023 report that fossil gas demand is projected to peak before 2030 under current stated government policies (STEPS). Figure 2-2, referencing IEA's World Energy Outlook 2022, showcases three scenarios: Stated Policies Scenario (STEPS), the Announced Pledges Scenario (APS), and Net Zero Scenario (NZE). While STEPS indicates the need for more LNG export capacity by 2050, the APS, which considers governmental pledges, expects the global LNG trade volume to peak around 2030, suggesting current constructions might largely satisfy future requirements. The stringent NZE scenario, aiming for a 1.5°C global temperature cap, foresees an imminent peak in LNG trade volume, implying that the present LNG infrastructure suffices for upcoming demands.

<sup>2</sup> <https://www.eia.gov/todayinenergy/detail.php?id=57000>

<sup>3</sup> Energy markets one year after the Ukraine invasion, Zero Carbon Analytics (2023)

<sup>4</sup> The LNG Industry GIIGNL Annual Report (2023), 8-9 pages

<sup>5</sup> Global LNG Outlook, IEEFA (2023)

## LNG Trade by Scenario Compared to Existing and Under Construction

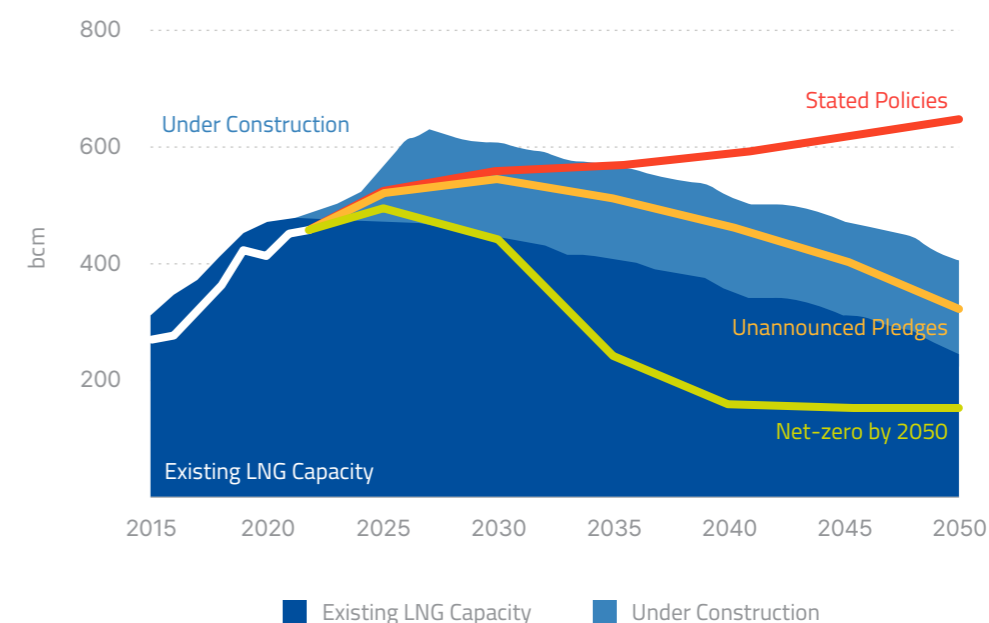


Figure 2-2 LNG trade by scenario compared to existing and under construction  
Source: World Energy Outlook, IEA (2022)

In its updated Net Zero Roadmap report, IEA reiterated that no new long-lead time upstream oil and gas projects are needed. They predict a 20% decline in fossil gas demand by 2030 in the NZE scenario.<sup>6</sup> This rapid decrease in LNG demand poses unprecedented risks for new entrants venturing into the market with new gas field development and LNG carriers. The fossil gas value chain had a 'Golden Age' in the past decade, primarily centered around the expansion of LNG. However, it now faces significant uncertainties due to geopolitical risks and the global response to climate change. Given this context, betting on LNG expansion poses significant risks for stakeholders.

<sup>6</sup> A renewed pathway to net zero emissions, IEA (2023)

<https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach/a-renewed-pathway-to-net-zero-emissions>

### 3 LNG Carrier: The Floating Pipeline Powering Global Fossil Gas Expansion

In the fossil gas value chain, LNG carriers serve as a floating pipeline, completing the expansion of the LNG value chain by connecting the supply and demand side of LNG. Once built, through long-term charter or spot charter contracts, LNG carriers lock in the trading volume of LNG for the vessel's lifespan, typically 25-30 years or more.

The value chain of LNG begins with exploration and production of fossil gas, followed by liquefaction of the gas into LNG and marine transportation via LNG carriers, and ends with regasification before reaching end users. LNG shipping represents a major component of the LNG value chain cost. Industry estimates show transportation can account for 20% of the total delivered cost of LNG as illustrated in Figure 3-1 below.

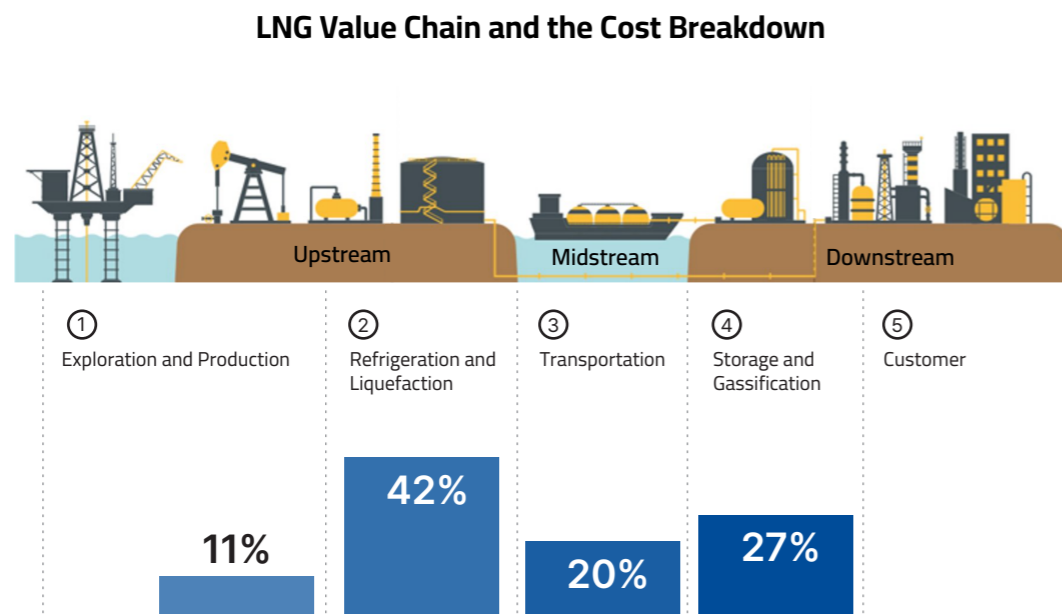


Figure 3-1 LNG value chain and the cost breakdown (costs for LNG receiving terminal and power plant excluded)  
 Source: SFOC, Fueling the climate crisis, SFOC (2021) & Key Issues and Challenges on the Liquefied Natural Gas (LNG) Value Chain, IECR (2018)

Liquefying fossil gas offers an alternative for the industry to transport fossil gas to distant demand sources where traditional pipelines are impractical. This process reduces the volume of fossil gas about 600 times. To provide context, South Korea imported about 3.64 million tons of LNG per month in 2023, according to data from the Korea Customs Service.<sup>7</sup> This translates into roughly 48 shipments per month, based on the use of 170,000 cubic meters LNG carriers.

<sup>7</sup> We divided the LNG import volume from the January to August period of 2023 into 8 to derive the monthly average LNG import volume. Raw data from the Korea Customs Service

Since the first LNG shipment in 1959 by MT "Methane Pioneer" from Louisiana, USA, to England, the number of LNG carriers has grown to more than 650 active ships. Due to the record-breaking new LNG carrier orders last year, around half (320 vessels) of current operating LNG carriers are under construction. Korean shipyards are overseeing the construction of approximately 80% of these carriers as of October 15, 2023.

#### 3.1 Stakeholders around LNG Carriers

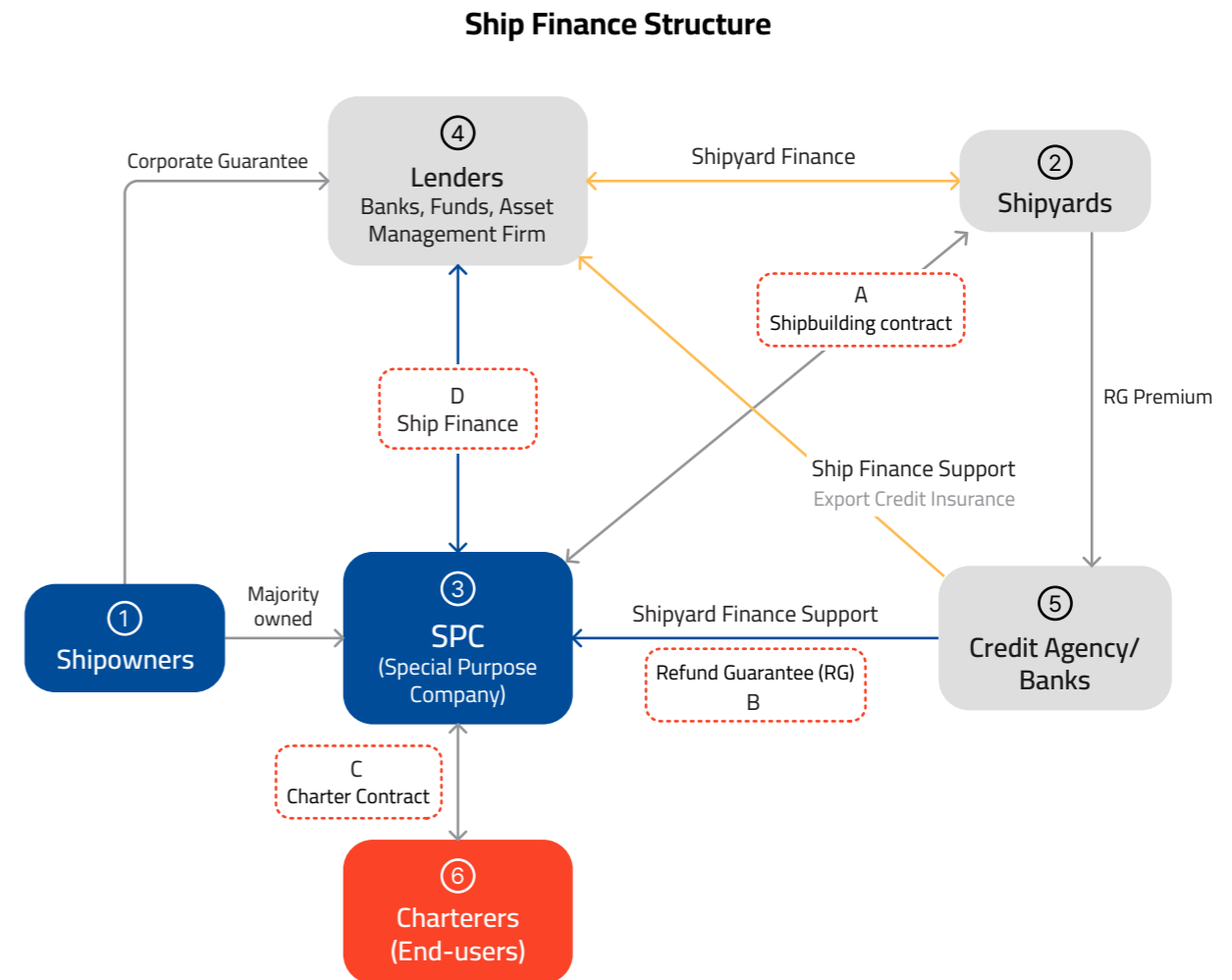
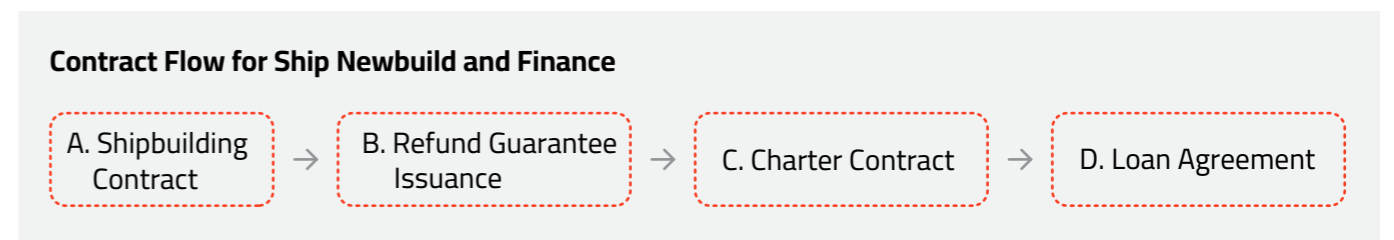


Figure 3-2 Dynamics in the shipping industry in ship finance  
 Source: SFOC



In the LNG carrier industry, various stakeholders play critical roles, each contributing to the expansion of the LNG shipping sector, by participating in the project finance structure of LNG carrier shipbuilding projects. Understanding the dynamics among these key players and their changing trends is essential for grasping the industry's current state, future challenges, and risks. The primary stakeholders in this industry include shipowners, financiers, shipyards, and major equipment suppliers. Before we dive further into specific stakeholders, let's have a quick look at the typical interaction among these stakeholders. Figure 3-2 above shows the relationships between shipyards, shipowners, financiers, and charterers in the context of typical ship finance structure. The contract flow begins once shipowners initiate a newbuilding order.

① **Shipowners** refer to enterprises that own and use vessels for profit. Historically, the term 'shipowner' was straightforward, referring to companies that both owned and managed their ships. However, the evolution of the industry has introduced entities like V ships and Wilhelmsen, which specialize in vessel operation and maintenance without owning the ships themselves. In this report, for clarity, we will use 'shipowners' as an inclusive term to denote companies that possess vessels, including shipping and maritime companies.

② **Shipyards** or shipbuilders include companies like Hyundai Heavy Industry or China State Shipbuilding Corporation (CSSC) in China that constructs commercial vessels. We will cover shipyards in detail in the next chapter. Shipyards also procure major equipment such as marine engines and LNG cargo tanks from equipment providers like the ones below:

- **Marine Engine Manufacturers:** MAN Energy solutions and Winterthur Gas & Diesel (WinGD) dominate the LNG carrier propulsion engine market, effectively creating an oligopoly. As for WinGD, it used to be part of Wartsila, a Finnish company, until they sold its shares to CSSC in 2015.
- **LNG Cargo Containment System Provider:** Gaztransport & Technigaz SA in France (GTT) is renowned in the LNG industry for its cargo containment systems. Essential for maintaining LNG at  $-163^{\circ}\text{C}$ , most large LNG carriers (above 125,000 cubic meters) use GTT's cargo tanks and shipyards typically pay GTT a 5% royalty of the vessel's cost.

③ **Special Purpose Company (SPC)** is a subsidiary created by a parent company to isolate financial risk in project finance. This arrangement safeguards lenders by insulating the asset from the broader financial risks of the shipowners. The SPC, while owned and backed by the shipowners, serves as the contracting party for shipbuilding agreements with shipyards and for loan contracts with financial institutions.

④ **Lenders**, comprising banks, investment funds, or asset management firms, provide financing to borrowers for the acquisition of ships. As previously noted, the funds from lenders are disbursed to the SPC, which then forwards the payments to shipyards in accordance with the shipbuilding contract. Lenders are categorized as senior or junior based on their loan-to-value ratio and their claim on the collateral.

⑤ **Credit Agencies** range from export-import banks, export credit or insurance agencies, and technology warranty companies, often affiliated with government bodies. These agencies enhance the creditworthiness of transactions by offering warranties or guarantees that mitigate the risk lenders face in relation to shipyards or borrowers. They provide instruments like export credit insurance or refund guarantees, enabling lenders to offer reduced interest rates, which in turn lowers the total repayment cost for borrowers.

⑥ **Charterers, End-users** are the main players in this ship financing scheme as they determine the ultimate credit quality of the loan. The success of project finance hinges on the credit standing of these end-users, who are the final signatories on charter contracts that trigger the subsequent shipbuilding and loan agreements. In the LNG shipping sector, charterers typically include major energy firms such as Shell or Chevron on the export side, or LNG traders and importers like KOGAS, Tokyo Gas, or electric utility companies.

### 3.2 LNG Shipowners

LNG shipowners play a pivotal role in connecting LNG producers with consumers, facilitating the maritime transportation of gas through their fleet of LNG carriers. Shipowners' decision on fleet expansion directly influences the industry's trajectory, so these decisions should be monitored carefully. LNG shipowners generate profit in three distinct ways:

- **Vessel Chartering:** Shipowners enter into contracts, known as vessel charter contracts, with end-users or charterers as seen in Figure 3-2 above. The tenure of these contracts can vary, ranging from as brief as a single voyage lasting around 15 days, to as extensive as the vessel's entire operational lifespan, which can be up to 30 years or longer. These charterers encompass a diverse group, from LNG exporters and importers to traders and even other shipowners.
- **Pool:** The industry has adopted the 'pool' concept in recent years. Under this model, shipowners contribute their vessels into collectively managed fleets called pools, operated by third-party operators like Cool Company. A designated pool company takes charge of commercial management of these pooled vessels. With this shift in commercial responsibility, the role and performance evaluation of the original shipowners now depend more on how efficiently they manage their cost of capital. This shift facilitated the entry of finance-backed shipowners into the LNG carrier industry, allowing companies without expertise in vessel commercial management to participate in the LNG shipping market, a topic we will delve into later in this section.
- **Asset Play:** Shipowners can also derive significant profits from the sale of their assets, capitalizing on favorable second-hand market. Often, the returns from these asset sales can be substantial, making it the largest profit source for some companies. However, this approach also comes with its share of risks, given the volatile nature of asset valuations.

### 3.2.1 LNG Shipowners in 2014 vs 2023

We conducted a comparative analysis of shipowners' composition and their respective fleets including ships on order, using data from IGU's World LNG Report 2014 and current data as of 15 October 2023 from Clarkson. A detailed comparison table can be found in *Appendix 2*.

Our aim was to identify which types of shipowners have significantly expanded their fleets in the past decade, and to understand the magnitude of their growth. For clarity, we use the following categorization.

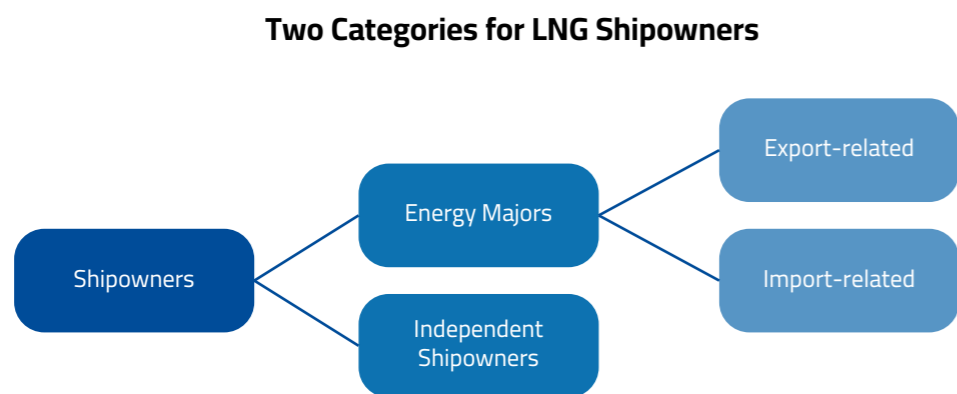


Figure 3-3 LNG Shipowners category  
Source: SFOC

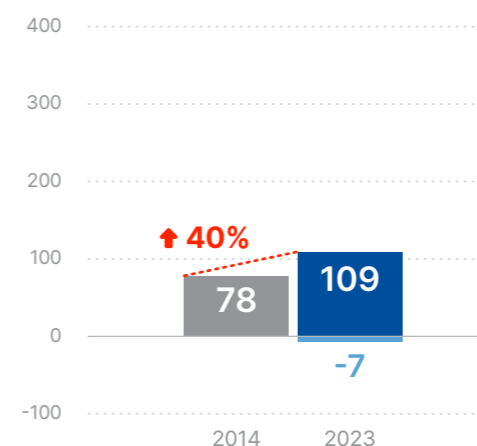
In contrast to other vessel types like bulk carriers or oil tankers, energy major companies played a significant role in the early development of the LNG shipping market. This involvement was driven by the complexity of cargo handling procedures and the need for compatibility between LNG carriers and ports, often owned by energy majors.

- **Energy majors:** We refer to energy major companies themselves or shipowners which are linked to energy majors either through joint ownership or via energy major's newbuilding program. Companies like Chevron, BP Shipping and Qatar Gas (Nakilat) belong to this category. We further subdivided them into export-related and import-related companies.
- **Independent Shipowners:** This category includes all the other companies that are not classified as energy majors. Examples include traditional shipowners with a long history of shipping legacy like Mitsui OSK Lines (MOL) and Nippon Yusen Kaisha (NYK) in Japan, Angelicoussis Group in Greece, and Knutsen OAS Shipping in Norway.

### Key Observations: Explosive Growth in Fleet Size and Shipowner Capacity

The LNG carrier fleet nearly doubled over the last 9 years, growing from 325 to 970 units, including 320 units presently on order. The number of shipowners that own those fleet increased by 40%, rising from 78 to 109 companies. During this period, 38 new shipowners entered the LNG shipping market, while 7 shipowners exited. The average fleet number per shipowners has increased from 4.2 to 9 vessels, nearly doubling. This trend signifies that the scale of individual shipowners also doubled in the last decade.

LNG Shipowners Growth by number of companies



LNG Shipowners Growth by fleet size

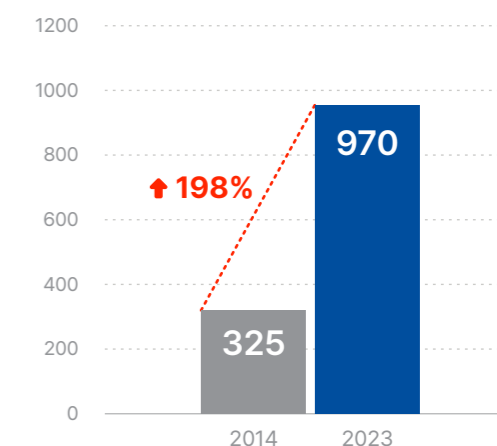


Figure 3-4 LNG Shipowners Growth (By the number of company-left, and by their fleet-right)  
Source: SFOC, World LNG Report, IGU (2014), Clarkson

**Key Observations: Independent Shipowners Dominate the LNG Shipping Market, Outweighing Energy Majors**

**LNG Fleet Ownership Snapshot in 2014 and 2023**

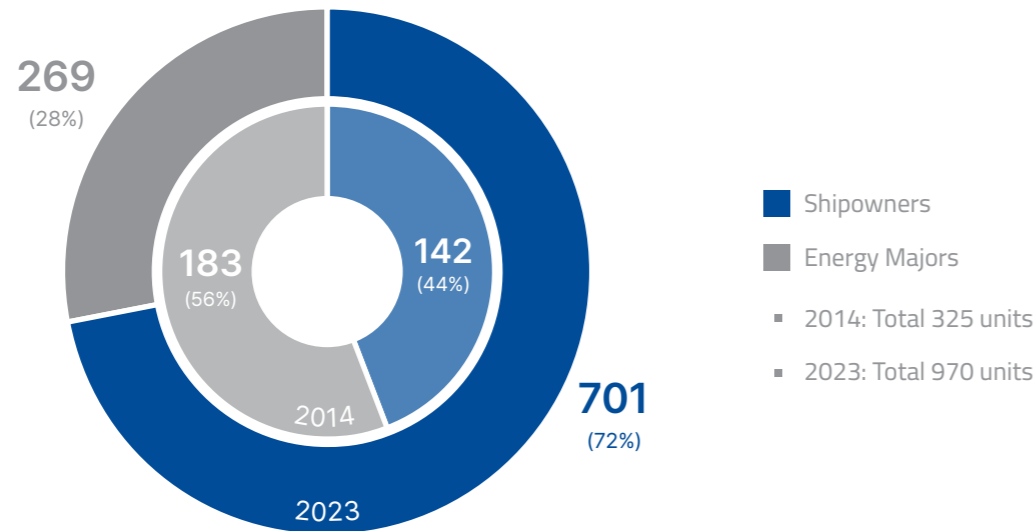


Figure 3-5 LNG Fleet ownership snapshot in 2014 and 2023  
Source: SFOC, World LNG Report, IGU (2014), Clarkson

There has been a discernible decline in the proportion of the LNG fleet owned by energy majors. While their fleet grew from 183 ships to 269 ships, representing a growth of 47%, the LNG fleet of traditional shipowners experienced explosive growth, surging from 142 ships to 701 ships. This equates to a staggering 394% increase in the LNG fleet operated by shipowners. As a result, the LNG fleet ownership ratio between shipowners and energy majors has dramatically flipped - from 44% vs 56% in favor of energy majors, to now 72% vs 28% in favor of shipowners. This highlights the dominating position independent shipowners have gained in the LNG shipping market.

**Key Observations: Shift in Energy Majors Involvement**

Data indicates a 24% growth in the fleet size of export-related companies, while import-related companies have seen a remarkable increase of 125% as illustrated in Figure 3-6. This shift correlates with changes in LNG cargo contract terms, moving towards Free On Board (FOB)<sup>8</sup> contract terms has shifted the responsibility for arranging transport onto LNG importers, prompting them to enter into the LNG carrier sector.

In the context of the changing landscape in LNG trading sector, the decline in the share of energy major companies may reflect a strategic withdrawal from asset-heavy investments in favor of more flexible and less capital-intensive models.

**LNG Fleet Owned by Energy Majors (Export vs Import)**

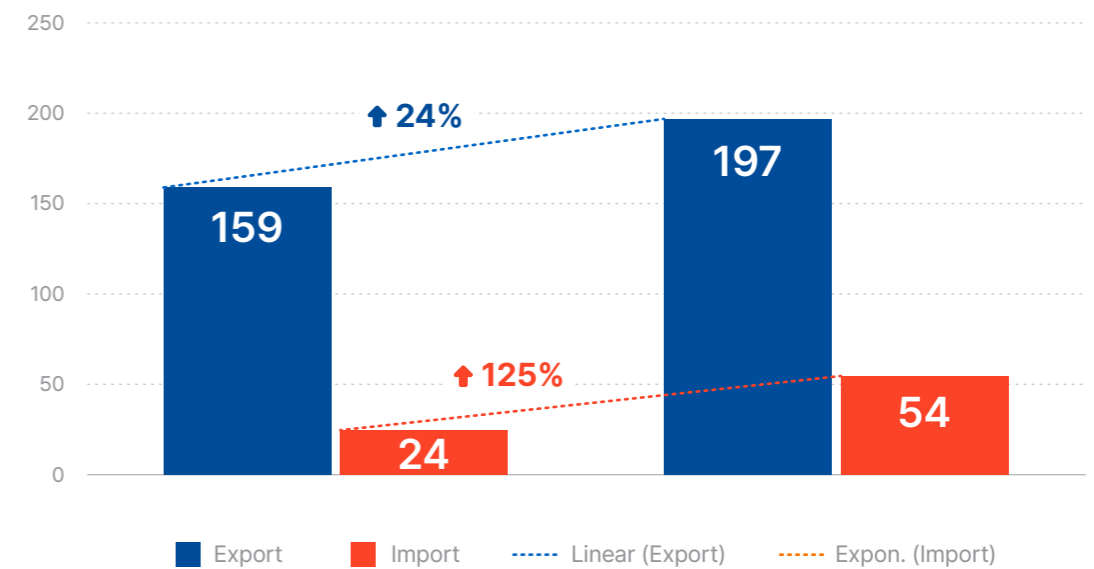


Figure 3-6 LNG Fleet Owned by Energy-majors (Export vs Import)  
Source: SFOC, World LNG Report, IGU (2014), Clarkson

<sup>8</sup> FOB in LNG shipping means the seller is responsible for delivering LNG to the LNG carrier at the loading port, after which the buyer takes on responsibility and costs, including the procurement of the ship.



### Further Analysis on New Shipowners Background: Finance-backed Shipowners Emerged

Through the comparative analysis of LNG shipowners and their fleet in 2014 versus 2023, we found out that 38 new shipowners appeared in 2023. We defined 'new' shipowners as those that either appeared for the first time in 2023 or grew from under 2 ships in 2014 to over 5 ships in 2023, in order to show meaningful trends. Further analysis found these new shipowners have backgrounds in private equity (PE), financing, or existing shipping companies. As for the New shipowners with PE Linked background, PE's share ratio ranges from having minority shares (as low as 7.21%) up to majority share or wholly owned.<sup>9</sup> Regarding the New shipowner's background identified as 'Financiers', companies that are classified as financial institutions such as China Development Bank and CSSC Leasing—a leasing arm under the China State Shipbuilding Corporation—belong to this category. Notable examples of spin-offs from shipowners subsequently acquired by PE are H-Line and Hyundai LNG Shipping, which we categorized as new shipowners despite their prior affiliations. A detailed list of all 38 new shipowners can be found in *Appendix 3*.

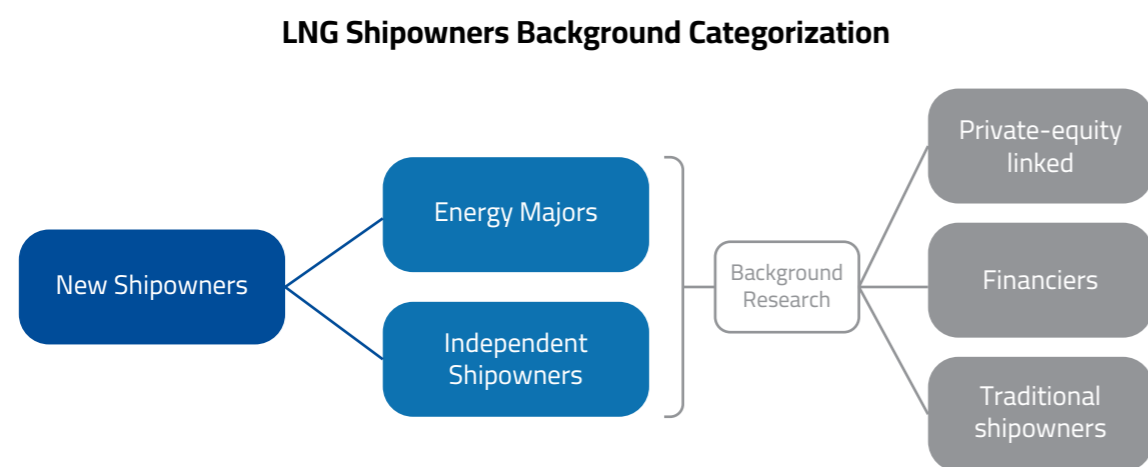


Figure 3-7 LNG Shipowners background categorization  
Source: SFOC

Of the 38 new LNG carrier shipowners, 8 (21%) are affiliated with energy majors - 7 related to LNG import/trading and 1 to export. The remaining 30 have no energy major ties. Respectively, energy majors account for 18 ships (7%) of the new entrants' fleet while independent shipowners account for 230 ships (93%) as shown in Figure 3-8. This further highlights the strong foothold shipowners have among new market entrants.

<sup>9</sup> Minority share refers to Vanguard holding 7.21% of Excelebrate Energy. Due to the limited data on non-listed companies, we anticipate that the actual involvement of PE may surpass the indications provided in this report.

Further analysis shows 10 of the new owners (26%) are private equity-backed, owning 112 ships, accounting for 45% of the new fleet. Another 6 owners (16%) are financed by leasing firms, possessing 14 ships and contributing to 6% of the new fleet. The remaining 22 owners (58%) are independent shipping companies transitioning from other vessel segments, holding 122 ships and making up 49% of the new fleet. In summary, about half of the recent new entrants are traditional shipowners moving into LNG carriers, while private equity and leasing companies account for the other half.

### New LNG Shipowners Fleet (Total 248 units)

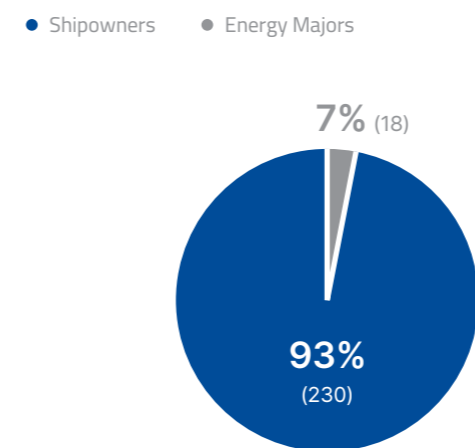


Figure 3-8 New LNG shipowners fleet  
Source: SFOC, World LNG Report, IGU (2014), Clarkson

### New Shipowners Composition by number of ships (Total 248 units)

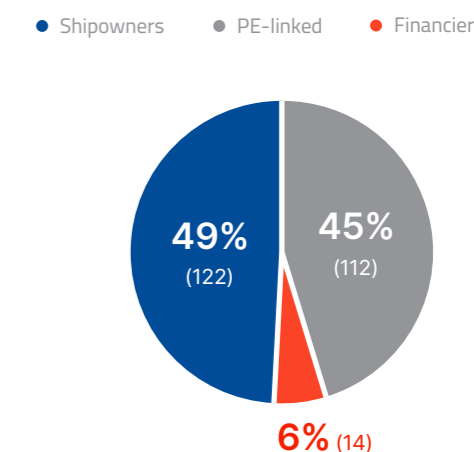


Figure 3-9 New LNG carrier owners' background composition  
Source: SFOC, World LNG Report, IGU (2014), Clarkson

This analysis reveals a dramatic expansion in the LNG carrier fleet, much of which is driven by traditional shipowners diversifying into LNG carriers and the influx of finance-backed companies. The scale of this growth raises questions about its sustainability and alignment with market demand, not to mention that it does not align towards an effort to mitigate climate change nor a just energy transition.

The emergence of private equity (PE) fund-linked shipowners in the LNG carrier sector is notable. Historically, private equity funds began their foray into the LNG shipping sector by purchasing the LNG fleets of traditional shipping firms in the late 2010s. Today, financial powerhouses have established their own specialized LNG shipping entities, such as Global Meridian, Oceaonix Services backed by JP Morgan, and Energos backed by Apollo Partners. This trend mirrors the rise of PE-backed LNG liquefaction facilities, particularly in the United States. After lifting a 40-year ban on crude oil exports in 2015, the US began exporting LNG in 2016 and quickly rose to the second-largest LNG exporter. Private equity has been a key driver in this expansion, backing 86% of existing LNG export terminal in the U.S.<sup>10</sup>

### Analysis on the Top 50 LNG Shipowners

Within the LNG fleet owned by the top 50 shipowners, as outlined in *Appendix 1*, traditional family-run shipowners with a long history, possess 629 ships, constituting 76% of the total fleet of 833 units. The remaining 204 units (24%) are associated with energy majors. Notably, PE-linked shipowners represent around 28% of the fleet, emerging as significant players in this sector.

#### Fleet Owned by Top 50 LNG Shipowners (Total 833 units)

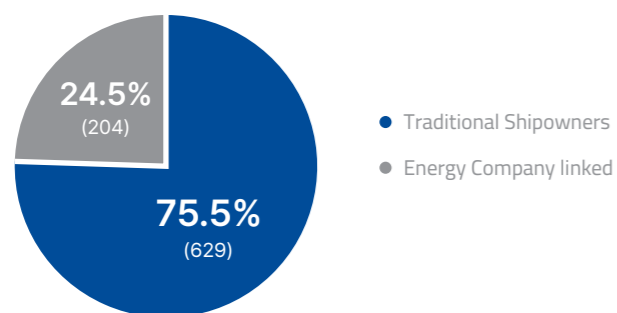


Figure 3-10 Composition of LNG fleet owned by the Top 50 LNG Shipowners (2023)  
Source: SFOC, Clarkson

#### LNG Floating Infrastructure Providers

Floating Storage and Regasification Units (FSRU) are used for LNG storage and regasification. Compared to traditional onshore regasification plants, FSRUs offer better flexibility, lower capital outlay and a faster means of importing LNG. FSRU Shipowners like Hoegh, Excelerate Energy and BW continue to operate the largest fleets of active FSRUs, while a new player New Fortress Energy entered the market in 2021 through the acquisition of Golar, a traditional LNG shipowner's FSRUs. Interestingly, large portions of these FSRU companies are again linked with private equity firms – Excelerate Energy by Vanguard, Energos by Apollo Partners, Golar LNG and BW LNG linked with Cobas Asset management.

<sup>10</sup> <https://pestakeholder.org/news/private-equity-fuels-lng-at-the-expense-of-communities-and-the-climate/>

### 3.3 Shipyards

Shipbuilding Companies (Shipyards): These firms are responsible for constructing the LNG carriers. They work closely with shipowners and end-users, often tailoring vessels to specific needs. Their capacity and technological capabilities can impact the availability and cost of new LNG carriers, thereby affecting the shipowners' operational dynamics. The construction of LNG carriers is more specialized than that of other commercial vessels like bulk carriers or oil tankers, with fewer shipyards capable of meeting the technical demands. Only shipyards licensed by GTT to use their designs, or those with their proprietary containment system technologies, can construct universally operable conventional large-size LNG carriers.

#### South Korean shipyards dominating LNG shipbuilding market, Chinese marched with 500% y-o-y growth

The three Korean shipyards - Hanwha Ocean, Hyundai Heavy Industries and Samsung Heavy Industries - have historically dominated LNG carrier orders since the 1990s. Their expertise in complex cryogenic containment systems makes them the preferred choice for most LNG shipowners.

#### LNGC on Order by Shipyard

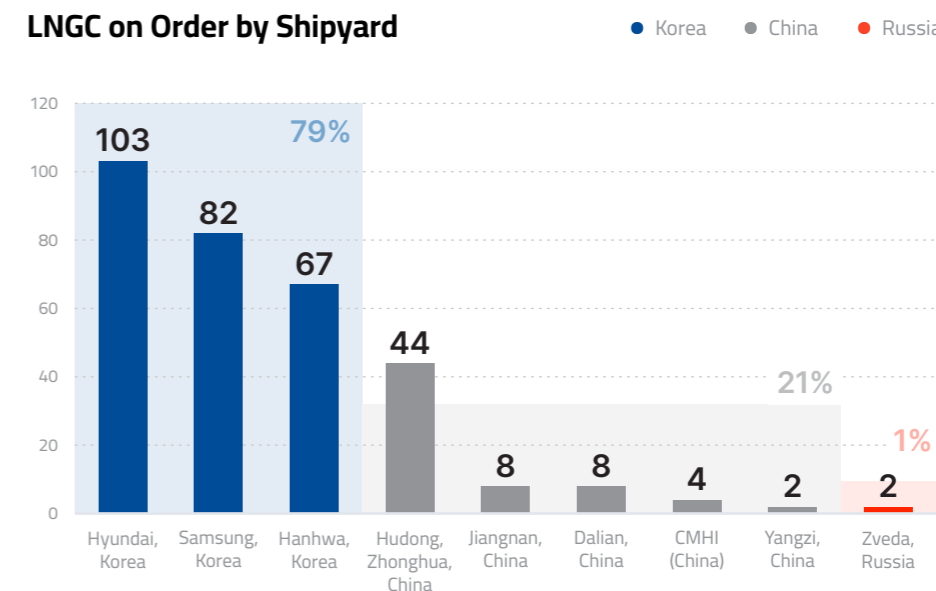


Figure 3-11 LNG carriers on order by shipyard as of 15 October 2023  
Source: SFOC, Clarkson

Over the years, some Chinese shipyards like Jiangnan, Dalian and Yangzijiang have started building LNG carriers, initially to serve domestic owners. Factors like limited Korean capacity and rising newbuild prices (reaching USD 250 million by the end of 2022 from USD 200 million at 2021's end) have recently drawn more conventional LNG carrier orders to Chinese yards. However, Korean shipyards continue to account for the lion's share of LNG carrier orders. As of October 2023, Chinese shipyards represent around 20% of the LNG orderbook compared to approximately 80% for their Korean counterparts as depicted in Figure 3-11 above. The expansion of Chinese yards provides more capacity and potential pricing competition, potentially making the LNG shipping market more elastic.

### 3.3.1 LNG Carrier Order Workflow: Speculative Orders

The LNG carrier newbuilding contracting needs to be strategically timed as it takes about three years or more to complete the LNG carrier construction. Due to its inelastic nature, Shipowners may decide to place a new ship order either after securing employment (Charter contract) for a vessel or even before signing a ship charter contract. For clarity of this report, we will term the latter—placing a ship order without having a secured employment—as a “speculative order.”

When placing a speculative order based on anticipated demand, shipowners evaluate factors such as LNG offtake contract volumes, final investment decisions (FID) for LNG liquefaction and regasification facilities, and energy mix announcement by major LNG importers etc. On the LNG carrier supply side, considerations include slot availability at shipyards, newbuilding prices, and expected delivery dates.

Let’s imagine we are in the shoes of a shipowner, keen on placing a speculative order for an LNG carrier. In such scenarios, shipowners typically follow the standard vessel technical specification provided by shipyards, ensuring the vessel will be compatible with most LNG terminals. Here’s a glimpse into the usual newbuilding contract process:

- ① Shipowners send out a Request for Proposal (RFP) to their chosen shipyards.
- ② In response, shipyards offer their budgetary quotes based on their standard specifications.
- ③ Negotiations then ensue between the shipowner and the shortlisted shipyards, where commercial terms such as shipbuilding price, payment terms, and delivery schedule are hashed out.
- ④ Upon reaching a preliminary agreement with the chosen shipyard, both entities sign a Letter of Intent (LOI), which remains valid for approximately a month.
- ⑤ Within the validity of this LOI, comprehensive discussions take place. Both parties dive into the shipbuilding contract’s commercial and legal aspects, alongside any technical specifications that might influence the final contract price.
- ⑥ Once the parties reach an agreement on the final contract terms, the shipbuilding contract, complemented by the technical specifications, is finalized and signed.
- ⑦ This contract becomes effective once the shipyard presents the shipowner with a refund guarantee (RG) from their banking institution.
- ⑧ The shipowner makes the first installment, setting the construction process in motion. The loan agreement in ship finance is signed after the issuance of the RG, aligning with the shipowner’s financing plan.



Figure 3-12 Newbuilding Contract Process  
Source: SFOC

### 3.3.2 LNG Carrier Order Workflow: Orders Driven by Energy Majors

Unlike the speculative order approach, energy majors, at times, take an active role in the shipbuilding order phase to construct LNG carriers for their exclusive use. Since ExxonMobil sets the precedent in 2022 for their newbuilding program where end-users select shipyards and secure slots prior to contracting shipowners, it has also become adopted by other energy companies like QatarEnergy.<sup>11</sup>

#### Growing Involvement of End-users in the Shipbuilding Process

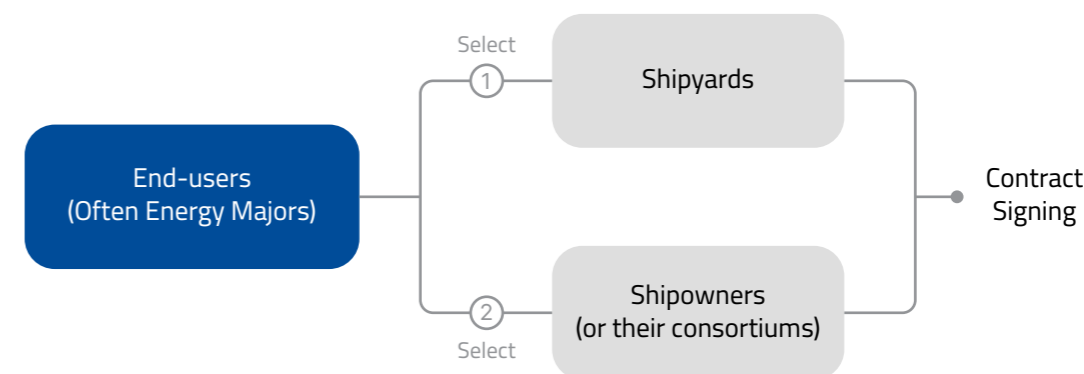


Figure 3-13 Growing Involvement of End-users in the Shipbuilding Order  
Source: SFOC

In this approach, as illustrated in Figure 3-13, end-users collaborate with their chosen shipyards to develop their own technical specification for LNG carriers that suit their needs, and then finalize preliminary commercial terms. Thereafter, they open closed tenders, inviting LNG shipowners to submit bids for the project. Shipowners calculate charter rates by incorporating their ship management and operating costs on top of the vessel contract price for the time charter contract period. Once shipbuilding contracts are signed, financiers step in to provide financing to shipowners. Unlike speculative orders discussed earlier, this method, led by energy majors, is preferred by financiers because it is backed by end-users with higher credit quality than typical shipowners from the beginning of the project. Loan agreements are typically signed after the shipbuilding contract. This model offers cost certainty to end-users as they have a clearer picture of the upfront costs (i.e. shipbuilding price) and potentially negotiate better deals by directly dealing with shipyards.

<sup>11</sup> As the world’s largest LNG exporter, Qatar’s state-owned QatarEnergy has been actively involved in LNG carrier newbuildings, securing shipyard slots for 66 vessels in 2022 and 17 more recently for its second newbuilding phase.

### 3.3.3 LNG Carrier Orderbook Development

Historically, the LNG carrier industry has experienced significant fluctuations in order volumes, largely influenced by key events that have shaped the fossil gas landscape. Here's how these pivotal moments correlate with surges and drops in the LNG carrier orderbook volumes:

#### LNG Carrier Orderbook History

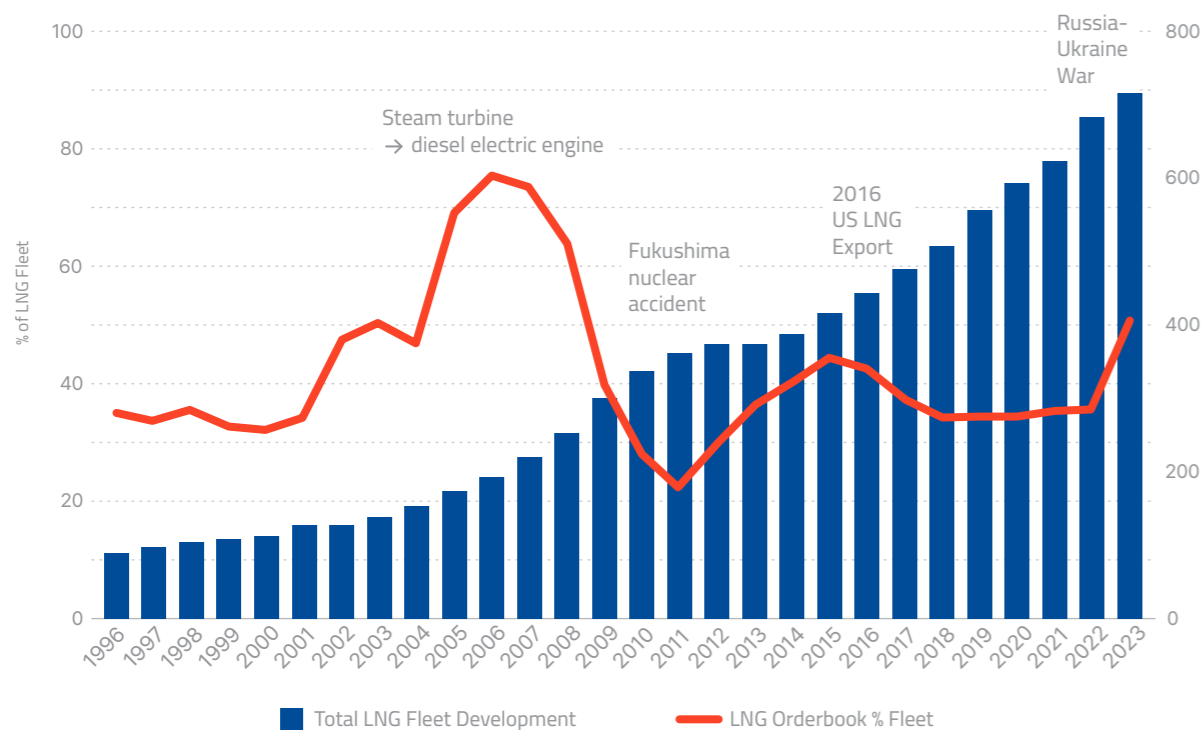


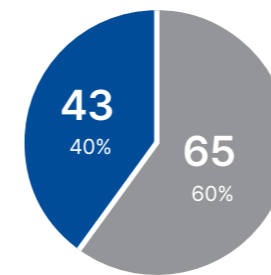
Figure 3-14 LNGC Orderbook Capacity History  
 Source: SFOC, Clarkson  
 Note: The line refers to the shares of LNG carriers on order in relation to the existing LNG fleet.

- 2006 Introduction of Diesel Electric Engine:** This technological advancement made LNG carriers more efficient, leading to a surge in orders – 88%.
- 2008 US Shale Gas Boom:** The sudden increase in U.S. fossil gas production created a new source of LNG, spurring demand for carriers to transport it.
- 2011 Fukushima Nuclear Accident:** The disaster led to a shutdown of nuclear plants in Japan, causing an immediate spike in LNG imports and, consequently, a rise in carrier orders.
- 2012 Commencement of US Sabine Pass LNG Export Terminal Construction:** This marked the U.S.'s entry into the global LNG export market, creating anticipation of increased LNG traffic.
- 2016 First LNG Export from the US by Cheniere:** Actual exports began, by this time the orderbook percentage had dropped to 40% due to a more stable market.
- 2021 Russia Gazprom Ceased the Piped-Gas Supply to Europe (Yamal-Europe pipeline):** This event led to a sudden surge in LNG as a replacement, driving up orders for carriers.

Now on October 15, 2023, the current orderbook stands at 320 vessels, making up 50% of the active fleet. This ratio is unprecedented in the modern LNG carrier era since 2010 as seen in Figure 3-14, indicating the industry's oversupply issue. According to the Climate Analytics and SFOC report (2023), the projected oversupply for the LNG fleet is estimated at 31% under the stated policy scenario, 34% in the announced pledges scenario, and a significant 65% under the Net Zero Emission by 2050 scenario.<sup>12</sup>

#### LNGC Orderbook in 2014 (Total 108 units)

● Chartered ● Speculative Order



#### LNGC Orderbook in 2023 (Total 320 units)

● Chartered ● Speculative Order

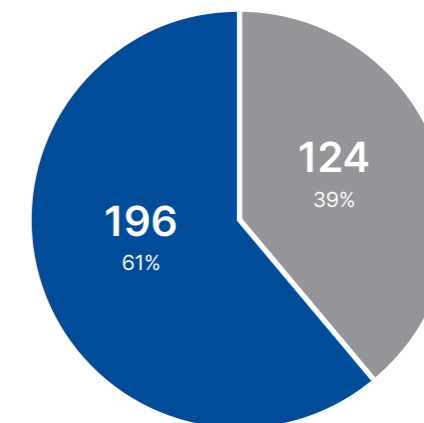


Figure 3-15 LNGC Orderbook ratio 2014 vs 2023  
 Source: SFOC, World LNG Report, IGU (2014), Clarkson

Note: As of 15 October 2023, we compiled publicly available information on the charter contracts of the newbuilding orders. This data was then integrated with Clarkson's data to calculate the number of speculative orders.

The IEA's Gas Market Report Q1-2023 reveals that LNG carrier orders soared to an all-time high of 165 in 2022, marking a 130% spike from the previous year. Remarkably, approximately 39% of these orders were speculative, as depicted in Figure 3-15. This ratio is alarming when we consider that the fleet tripled in numbers, implying unprecedented uncertainties and risks for stakeholders. The LNG market's optimistic prospects, as seen in 2014, are no longer guaranteed. Surpassing global LNG trading volumes under the stated policy scenario, the market faces a permanent oversupply as the global shift toward the net-zero goal accelerates renewable deployment, further reducing the demand for fossil gas.

<sup>12</sup> High and dry: The global energy transition's looming impact on the LNG and oil shipbuilding industry, Climate Analytics and SFOC (2023)

## 4 South Korea's Public Financing in LNG Carriers

Heavy industries like shipbuilding serve its strategic role in driving economic growth in developing nations. Countries such as Japan, Korea, China, and now India have leveraged heavy industries to create jobs and boost exports, thereby generating foreign revenue. These nations heavily rely on public financing to support such industries. However, with the evolving landscape in the LNG sector, shaped by volatile fossil fuel industries and a rapid transition toward renewables, it becomes imperative for these countries to carefully assess their financial support to heavy industries. This scrutiny ensures that public funds align with global climate targets and are not locked into unsustainable. Climate Analytics' 2023 report finds that under the IEA's Net Zero Emissions scenario aligned with Paris Agreement goals, no new LNG carrier builds would be compatible with limiting warming to 1.5°C. Persisting with financial support for new orders could result in a situation similar to "pouring water into a leaky bucket," leading to stranded assets.

While this report focuses on data from Korea's public financing sectors, the issue is not confined to Korea alone. It also pertains to China, where the share of LNG carrier orders has seen a recent uptick, and Japan, where numerous legacy LNG shipowners leverage affordable financing to place speculative orders for LNG carriers.

In this section, we delve into the financing support extended from 18 March 2013 to 10 August 2023 for LNG carrier projects by three public financial institutions and two maritime-focused public agencies, namely the Korea Development Bank (KDB), Export-Import Bank of Korea (KEXIM), Korea Trade Insurance Corporation (K-SURE), Korea Ocean Business Corporation (KOBC), and Korean Asset Management Association (KAMCO). The data was obtained in consultation with the office of Gu Ja-geun, a member of the South Korean National Assembly, and included: (i) details of the guarantees provided; (ii) details of the loans provided; (iii) details of the equity investments made; (iv) the parties to the contract; and (v) project region.

### 4.1 Financing Structure of LNG Carriers Ship Finance

The total of 12 different types of LNG vessel-related financial support were classified into four main categories: 1. Ship finance; 2. Ship finance support; 3. Shipyard finance; and 4. Shipyard finance support. The primary criterion for this categorization is whether the beneficiary is a shipowner that owns and leases ships or a shipyard constructing LNG vessels. Additionally, another factor that was taken into consideration is whether the financial support is direct funding or an indirect mechanism in a form of guarantee or insurance so as to promote financing activities for shipowners or shipyards. The structure map and the table on the next page describe their roles and the interaction among each player.

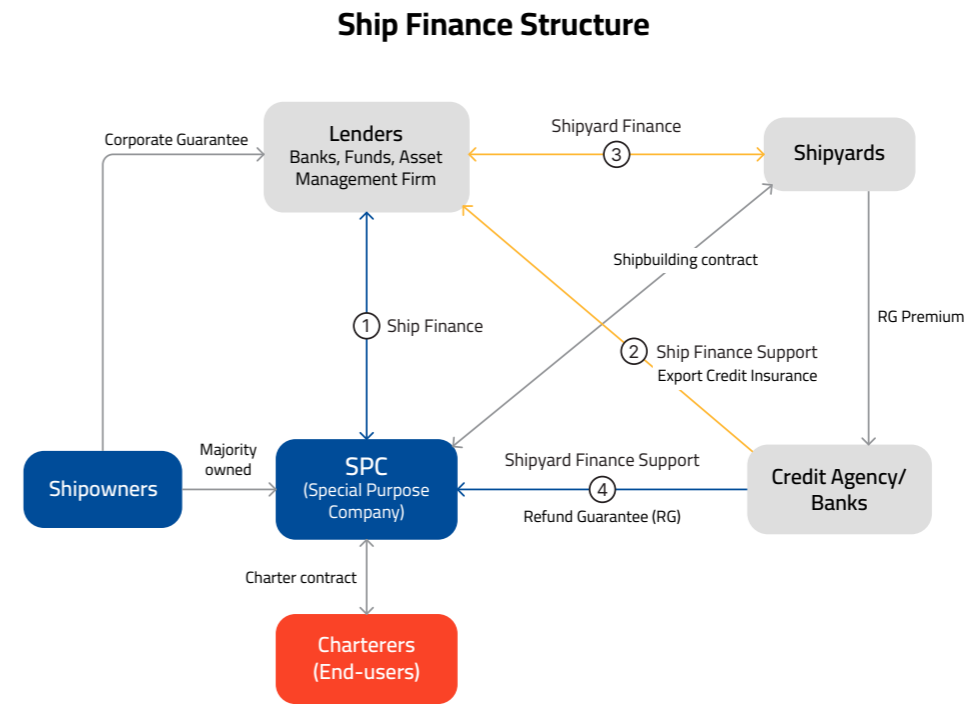


Figure 4-1 Ship Finance Structure  
Source: SFOC

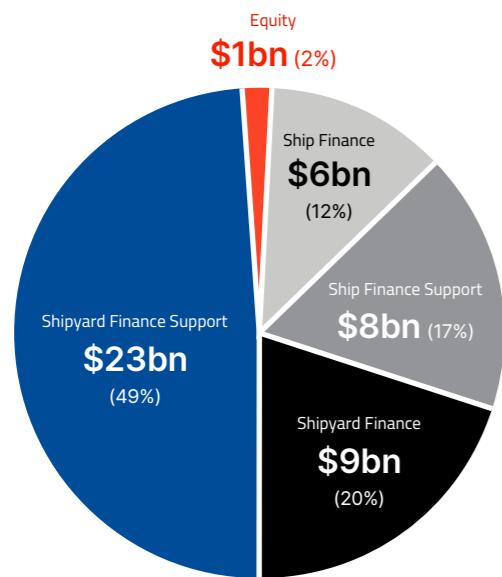
Role	Type
① Ship Finance	<ul style="list-style-type: none"> <li>Funding provided for ship purchases made by shipowners. This is backed by the vessel as a collateral, and the charter contract as a project revenue</li> <li>Sale and Leaseback</li> <li>Ship Funds</li> <li>Senior and Subordinated Loans</li> </ul>
② Ship Finance Support	<ul style="list-style-type: none"> <li>Insurance/guarantee products provided to a ship finance received by a shipowner from another financial institution to reduce the shipowner's financing costs through discounted interest rates</li> <li>Ship Introduction Guarantee</li> <li>Export-related Financial Guarantee</li> <li>Export Bond Insurance</li> <li>Medium and Long-term Export Credit Insurance</li> </ul>
③ Shipyard Finance	<ul style="list-style-type: none"> <li>Funding provided directly to shipyards</li> <li>Export Facilitation Loan</li> <li>Export Project Loan</li> <li>Export-based Loan</li> </ul>
④ Shipyard Finance Support	<ul style="list-style-type: none"> <li>Insurance/guarantee products tailored to address risks originated from shipyards</li> <li>Advance Payment Bond</li> <li>Warranty Bond</li> <li>Refund Guarantee</li> </ul>

Figure 4-2 Categories of Ship Finance  
Source: SFOC

### 4.2 Breakdown by Financial Product Category

Over the past decade, there have been 679 financing cases from Korean public financing institutions for LNG carrier projects amounting to a total of \$47bn received in financial support. This came in the form of loans [1. Ship Finance and 3. Shipyard Finance] or guarantees [2. Ship Finance Support and 4. Shipyard Finance Support], totaling \$46.3bn, and equity investments amounting to \$0.7bn. Given that the equity component is relatively small, and it was to assist second-hand LNG vessel purchase, rather than financing assist for LNG carrier newbuilding, it was excluded from subsequent analysis.

#### Korea's Ship Financing Distribution by amount

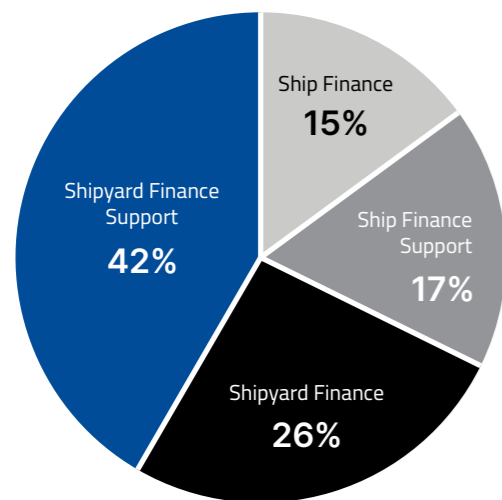


Of the four financing categories discussed, in terms of financing size, 4. Shipyard finance support ranked first with a total of \$23.2bn. Within this category, 'Advance payment bond' was the predominant financial product.

Figure 4-3 Korea Ship financing distribution 2013-2023  
Source: SFOC, Korea National Assembly Audit

Note: The data was rounded to the first decimal place.

#### Most Used Ship Financial Product in Korea



The distribution pattern remained the same based on the number of financing cases: more than half (68%) of these cases involved support for shipyards. While guarantees remained the predominant form of support, constituting 42% of all cases, there was a notable increase in the proportion of cases involving loans [3. Shipyard Finance] to shipyards.

Figure 4-4 Most used financial product by financing case  
Source: SFOC, Korea National Assembly Audit

### South Korea's Public Financing in LNG Carriers (2013-2023)

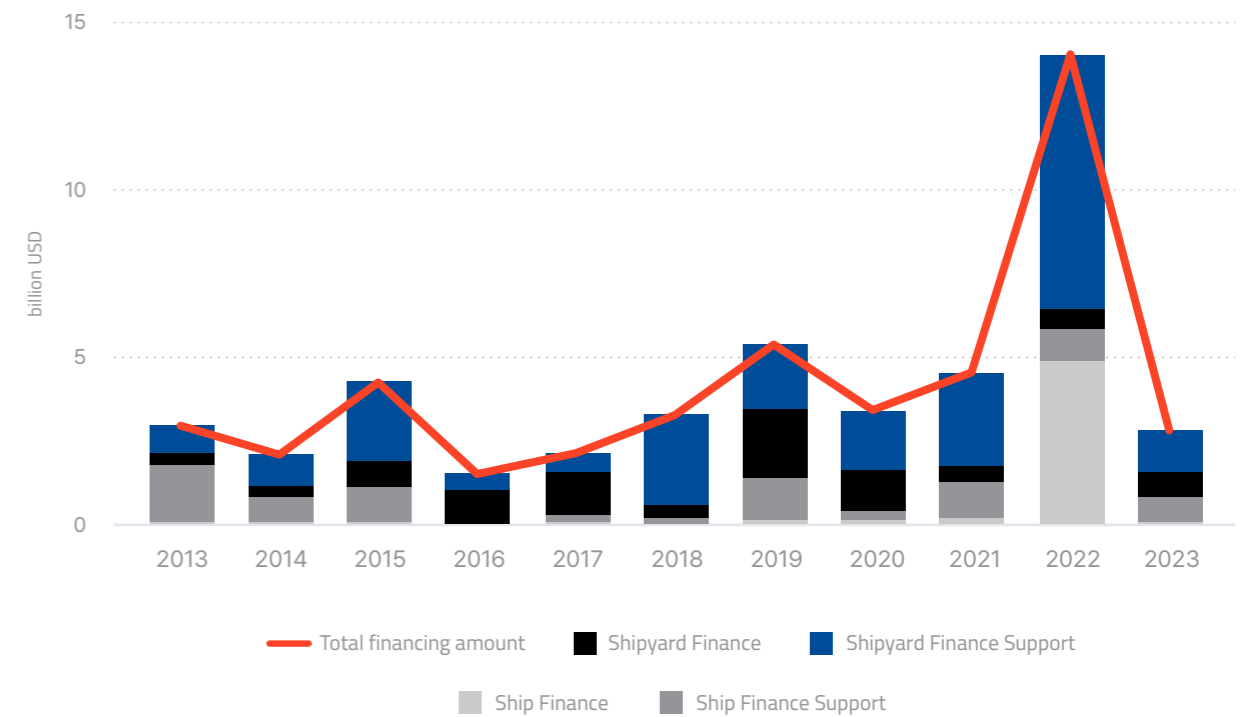


Figure 4-5 South Korea's Public Financing in LNG Carriers  
Source: SFOC, Korea National Assembly Audit

The yearly trend drawn on the data from the National Assembly in Figure 4-5 shows that the record number of newbuilding orders for LNG vessels led to 2022 being the peak year for financial contracts too. In that year, both 1. Ship Finance and 4. Shipyard Finance Support were more frequently utilized than the other financing categories. The spike in ship finance in 2022 can be attributed to numerous Korean shipowners participating in Qatar's newbuilding program. Consequently, the surge in Shipyard Finance Support the same year is due to the peak in order volume in 2022, primarily in the form of refund guarantee to shipowners. This trend suggests increased shipyard finance in the coming years, as shipyards will need export-based loans for construction. This pattern was observed in 2018, where there was a surge in shipyard finance support, followed by subsequent shipyard finance increase in 2019 and 2020. However, with most Korean shipyards having their yard slots booked until 2026 or 2027, there has been a decrease in new building contracting activity from Korean shipyards in 2023, which led to the shift of ship orders to Chinese shipyards. This is consistent with the reduction in Shipyard Finance Support in 2023.

### 4.3 Breakdown by Public Financial Institution

Looking at financial institutions, KEXIM participates in project financing deals both as a lender and as a credit agency for loans made by other institutions, as well as offering performance bonds. KDB engages in both lending and guarantee-related activities. K-SURE, on the other hand, specializes in insurance and guarantee-related services as a credit agency, without a lending function.

When it comes to ocean-related agencies, KAMCO has established a shipping fund as a vehicle to finance LNG carriers, as well as provided equity investment via KDB Infrastructure Asset Management (KDB's subsidiary). Meanwhile, KOBC primarily focuses on ship funds and guarantees, as well as buying out older LNG carriers and leasing them to maritime companies.<sup>13</sup>

#### Korean Ship Financing Breakdown by Institution

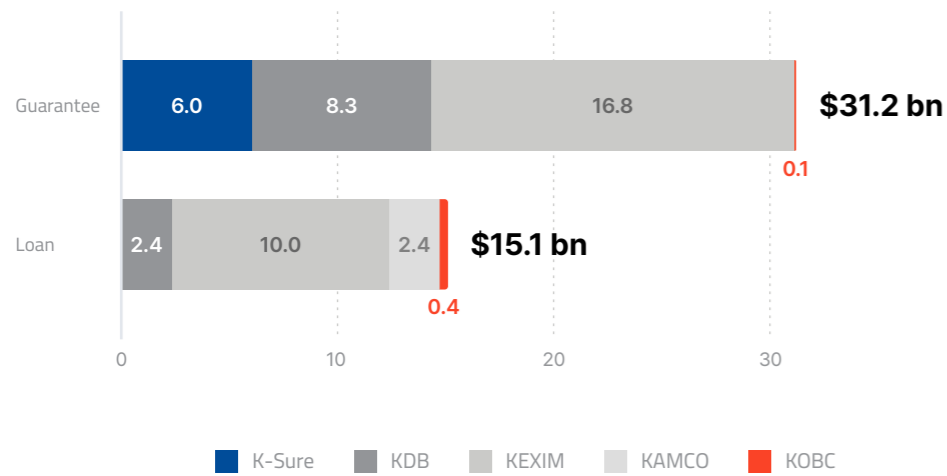


Figure 4-6 Breakdown of financing support from financial institutions by type (unit: billion USD)  
Source: SFOC, Korea National Assembly Audit

Note:  
Korea Development Bank (KDB)  
Export-Import Bank of Korea (KEXIM)  
Korea Trade Insurance Corporation (K-SURE)  
Korea Ocean Business Corporation (KOBC)  
Korean Asset Management Association (KAMCO)

In terms of distribution, the combined financing from the five entities amounts to \$31.2bn in guarantees [2. Ship Finance Support and 4. Shipyard Finance Support] and \$15.1bn in loans [1. Ship Finance and 3. Shipyard Finance]. The higher proportion of guarantees can be attributed to the inclusion of refund guarantees, which typically involve substantial amounts.

On an institution-by-institution basis, KEXIM provided the largest share of financing both in terms of financing size (the total financing amount of \$26.8bn, of which \$16.8bn was provided in guarantees to shipowners and shipyards) and the number of financing cases. K-SURE provided \$6bn just in the guarantee segment, and KDB has contributed \$2.4bn in loans and \$8.3bn in guarantees (mostly to shipyards). Both KAMCO and KOBC predominantly offered category 1. Ship Finance.

<sup>13</sup> Fueling the Climate Crisis: South Korea's Public Financing for Oil and Gas, SFOC (2021)

### 4.4 Breakdown by Financing Destination

The findings from this section suggest that Korean public finance is playing a significant role in the global expansion of LNG carriers. As the main objective was to gauge the extent of Korean public finance channeled overseas, the following analysis is focused on the financing dedicated to shipowners only, namely 1. Ship Finance and 2. Ship Finance Support, since shipyard finance and related financial support products are aimed at domestic shipyards.

In examining ship finance destinations for 1. Ship finance, approximately 93% of the financing amount (\$5.5bn) was directed to support domestic LNG shipowners. The remaining 7% (\$0.4bn) was provided by KDB to assist in the expansion of LNG fleets of Greece, Bermuda, Singapore, and China-based shipowners.

#### Domestic vs. Overseas Shares of Korean Public Ship Finance

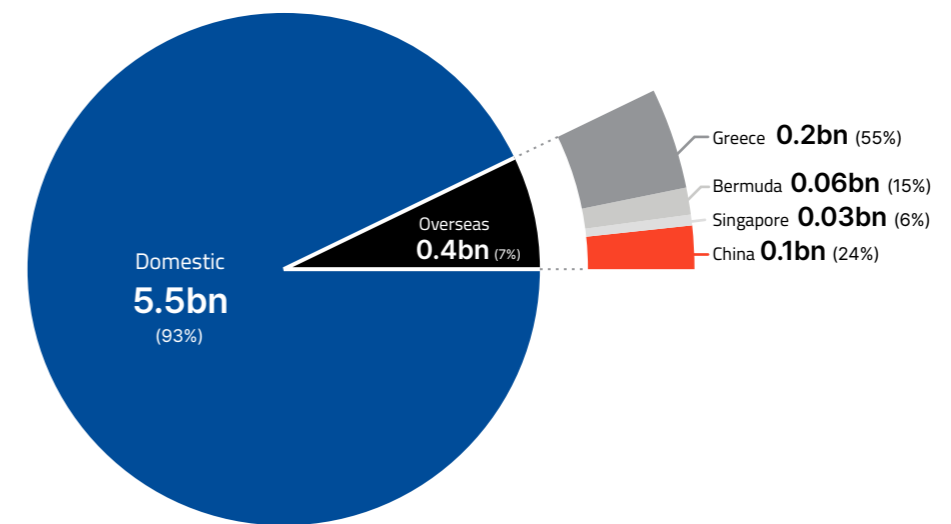


Figure 4-7 Domestic vs. Overseas share of ship finance (unit: financing amount)  
Source: SFOC, Korea National Assembly Audit

In the case of 2. Ship finance support, 99% of the financing amount (\$7.9bn) was directed towards overseas destinations, while only 1% (\$0.1bn) was targeted domestically with the assistance of the KOBC. The financing to overseas destinations was distributed between K-Sure and KEXIM with a ratio of 76% (\$6bn) to 24% (\$1.9bn) of the total.

Upon closer examination, K-Sure has allocated financing to a diverse array of countries, including Germany, Liberia, Russia, the Marshall Islands, Malaysia, Malta, Bermuda, Cyprus, Singapore, and France. KEXIM, on the other hand, primarily directed its financing towards shipping companies based in the UK (34%), Norway (25%), Greece (23%), France (14%), and China (4%).

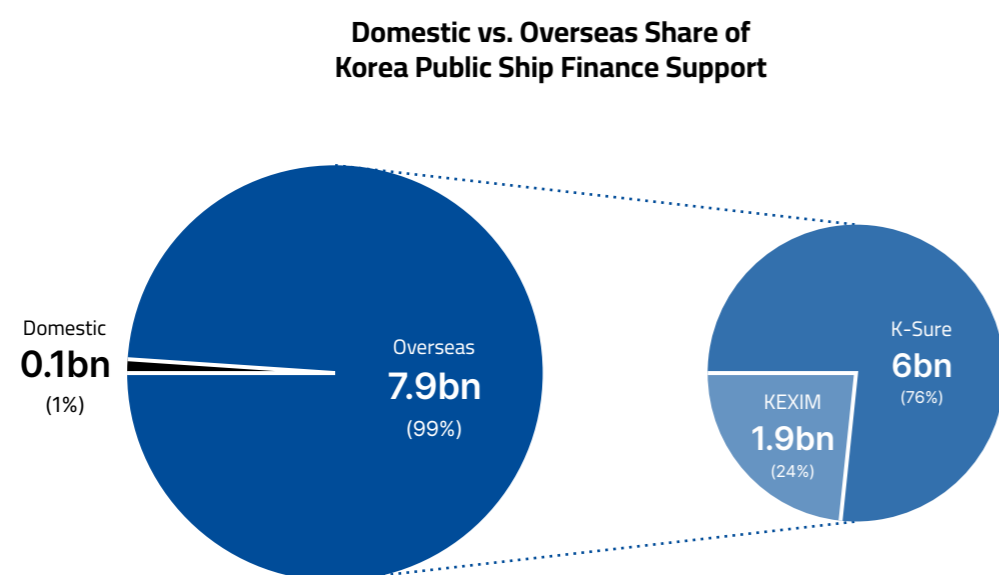


Figure 4-8 Domestic vs. Overseas share of ship finance support (unit: financing amount)  
Source: SFOC, Korea National Assembly Audit

## 5 Emerging Risks in the LNG Carrier Market

The number of LNG carriers serving the expansion of the global LNG value chain tripled over the last 10 years. This expansion has cemented LNG's status as the dominant market for fossil gas. However, the exponential expansion of LNG carrier fleet has also pulled existing players including East Asian shipyards and public financiers deeper into the rising risks of fossil fuel financing. Newly joined LNG shipowners, such as private equity-linked shipowners and traditional shipowners, now face the same risk. While LNG has been framed as a transitional fuel, the long lifespans of LNG carriers and infrastructure create the risk of locking in emissions for decades. As momentum builds for reduced fossil fuel reliance, the industry must reconcile the disconnect between emissions goals and the ongoing expansion of LNG fleet capacity.

### 5.1 Financial and Commercial Risks

Last year, stakeholders of the LNG shipping industry viewed the energy crisis triggered by Russia's invasion of Ukraine and the restructuring of the fossil gas supply chain as a significant opportunity, leading to record-breaking orders for new LNG carriers. Over the next 3-5 years, LNG shipping capacity is expected to increase by 50% as these LNG vessels start service.

However, contrary to the industry's expectation, the demand for fossil fuel has begun trending downwards. The price volatility of fossil fuels, exacerbated by last year's energy security crisis, has accelerated the energy transition worldwide. As a result, as suggested by IEA last year, the outlook for fossil fuels is projected to decrease across all scenarios for the first time in history. In the updated Net Zero report published by IEA this year the demand for fossil gas should decrease to 23% of current levels by 2050. Ultimately, as global climate policies and energy transitions strengthen in line with carbon neutrality objectives, the demand for LNG is expected to shrink rapidly.

Consequently, the LNG shipping market faces severe overcapacity risk and derailment due to the decreasing fossil gas demand. Shipowners, who require long payback of initial investments through long-term charters, banks and public financiers who provided loans with decades of repayment schedule, are particularly expected to face the impact of market changes.

Meanwhile, East Asian shipyards, which have consistently secured stable cashflows through bagging LNG carrier orders in recent years, are also expected to be affected by the drop in new orders. In South Korea, for example, LNG carrier orders played a significant role in alleviating the shipbuilding industry's downturn in the 2010s. From 2018, LNG carriers consistently accounted for around 20% of the new order volume (based on DWT) in the Korean shipbuilding industry, and this figure increased to about 50% in 2022. Without transitioning towards offshore wind & green fueled base alternative shipbuilding orders, a sharp drop in LNG carriers could directly impact these shipyards.



## 5.2 Climate Risks

The world has experienced a catastrophic climate crisis this year, leading to assessments that 'the era of global warming' has ended. In July 2023, UN Secretary-General Antonio Guterres also warned that 'the era of global boiling' has arrived. In March the same year, The Intergovernmental Panel on Climate Change (IPCC), an epistemic community of climate scientists, recommended that 'greenhouse gas emissions must peak before 2025 at the latest and fall by 43% at least below 2019 levels by 2030' to limit global temperature rise to 1.5°C in their 6th Assessment Report (AR6)<sup>14</sup>.

The worsening climate crisis underscores the urgent need for rapid fossil fuel phase out, leaving no room for new fossil fuel projects to wedge in. Under the imminency of climate crisis, new investments related to oil and gas assets or companies reliant on their revenue on LNG related projects could damage the reputations of financial institutions.

Across the LNG value chain, LNG carriers play a crucial role connecting LNG supply and demand. As a result, global pressure is mounting on the LNG shipping and shipbuilding industry, as well as their investors, as their actions enable continued LNG expansion that is at odds with climate goals.

Exclusion on oil and gas industries has already begun among global financial institutions. Financial institutions such as HSBC<sup>15</sup>, Societe Generale<sup>16</sup>, BNP Paribas<sup>17</sup>, Allianz<sup>18</sup>, Munich Re<sup>19</sup>, and others have declared exclusions on financing upstream oil and gas development projects. As global pressure on financial institutions increases, it is expected to expand further across oil and gas value chains, including the LNG shipping market.

<sup>14</sup> <https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/>

<sup>15</sup> Energy Policy, HSBC (2022)

<https://www.hsbc.com/-/files/hsbc/our-approach/risk-and-responsibility/pdfs/221214-hsbc-energy-policy.pdf?download=1>

<sup>16</sup> Oil & Gas Sector Policy, Societe Generale (2023)

<https://www.societegenerale.com/sites/default/files/documents/CSR/Oil-Gas-sector-policy.pdf>

<sup>17</sup> Sector policy – Oil & Gas, BNP Paribas (2023)

[https://cdn-group.bnpparibas.com/uploads/file/bnpparibas\\_csr\\_sector\\_policy\\_oil\\_gas.pdf](https://cdn-group.bnpparibas.com/uploads/file/bnpparibas_csr_sector_policy_oil_gas.pdf)

<sup>18</sup> [https://www.allianz.com/content/dam/onemarketing/azcom/Allianz\\_com/responsibility/documents/Allianz-Statement-oil-gas-business-models.pdf](https://www.allianz.com/content/dam/onemarketing/azcom/Allianz_com/responsibility/documents/Allianz-Statement-oil-gas-business-models.pdf)

<sup>19</sup> Munich Re's approach to fossil fuels in underwriting and investment, Munich Re (2022)

[https://www.munichre.com/content/dam/munichre/contentlounge/website-pieces/documents/MunichRes-approach-to-fossil-fuels-in-underwriting-and-investment.pdf/\\_jcr\\_content/renditions/original/MunichRes-approach-to-fossil-fuels-in-underwriting-and-investment.pdf](https://www.munichre.com/content/dam/munichre/contentlounge/website-pieces/documents/MunichRes-approach-to-fossil-fuels-in-underwriting-and-investment.pdf/_jcr_content/renditions/original/MunichRes-approach-to-fossil-fuels-in-underwriting-and-investment.pdf)

## 6 Recommendations

As covered in the last chapter, oversupply of LNG fleet will be fortified when it confronts the rapid transition of global energy system toward renewables. To mitigate risks, players in the LNG shipping market need to implement measures to adapt. Furthermore, considering the complexity of the LNG shipping market where various stakeholders interact, it is essential to provide recommendations tailored to different stakeholders of the market. Therefore, in this report, we intend to present recommendations for various stakeholders as follows:

### 6.1 To Financiers

Both public and private financiers should immediately cease financing new LNG carrier shipbuilding projects to avert stranded asset risks. Especially, financing for speculative LNG carriers, lacking long-term charter contracts, exposes financiers to the inherent volatility of the LNG shipping market.

To mitigate climate-related risks, private investors should establish divestment criteria and start engaging with stakeholders highly reliant on their revenues from LNG shipping market. This isn't restricted to shipowners and shipping companies; it extends to shipyards, equipment suppliers and cargo technology licensors.

### 6.2 To Shipowners

Shipowners, on the other hand, should stop exposing themselves to the jeopardizing market. Given the 35-year lifespan of LNG carriers, most of the LNG vessels on orderbook would risk becoming stranded assets before their expected lifespan as the global economy rushes toward Net Zero target. The secondhand LNG carrier market could also face a sharp depreciation in value as the LNG shipping market transitions from a 'blue ocean' of opportunities to a 'red ocean' of competition. Shipowners who maintain a high dependence on LNG carriers may experience significant profit volatility due to the unpredictable nature of fossil fuel prices. To alleviate risks, shipowners should transition their portfolios into the Paris-aligned trajectory.

### 6.3 To Shipyards

Shipyards in Korea and China should diversify into renewable energy sectors or innovative technologies, rather than adhering to the inertia of the past. This inertia not only hinders global climate targets but also impedes progress towards sustainable transition, potentially locking companies into stranded assets.

## 7 Appendix

### 7.1 Appendix 1. Top 50 LNG Shipowners

Owner Group	Total Fleet	Avg. Age	Country	Remarks
Mitsui OSK Lines	58	9.0	Japan	
Nippon Yusen Kaisha	53	8.7	Japan	
Angelicooussis Group	53	7.2	Greece	
Qatar Gas (Nakilat)	43	15.8	Qatar	Energy major linked
Knutsen OAS Shipping	41	7.0	Norway	
Seapeak	38	11.7	Bermuda	Spun-off from Teekay, PE Linked (Stonepeak Infrastructure Partners)
BW Group	31	10.6	Bermuda	PE linked (Cobas Asset Management)
Dynacom	31	7.6	Greece	PE linked (Cobas Asset Management)
Petronas	30	16.2	Malaysia	Energy major linked
GasLog	29	7.7	Greece	
Cardiff Marine	24	6.1	Greece	
Oceonix Services Ltd	21	0.8	UK	PE linked (JP Morgan)
Capital Maritime	18	6.2	Greece	PE linked (Smith (Donald) & Company Inc.)
Celsius Shipping	18	1.9	Denmark	PE linked (Breakwater Capital & Bayside Capital)
H-Line Shipping	17	14.5	South Korea	PE linked (Hahn & Co.)
Hyundai LNG Shipping	17	19.7	South Korea	PE linked (IMM)
China COSCO Shipping	16	4.3	China P.R.	
SK Shipping	16	13.2	South Korea	PE linked (IMM)
K-Line	15	10.7	Japan	
Nigeria LNG	13	13.8	Nigeria	Energy major linked
ADNOC	13	27.7	U.A.E	Energy major linked
Eastern Pacific Shpg	13	7.6	Singapore	
H-Line/Pan Ocean/SK	13	0.0	South Korea	Energy major linked (Qatar project consortium)

Owner Group	Total Fleet	Avg. Age	Country	Remarks
NYK K-Line MISC CLNG	12	0.0		Energy major linked (Qatar project consortium)
Leif Hoegh & Co	12	9.8	Norway	
Fredriksen Group	11	3.4	Cyprus	
Excelerate Energy	11	13.6	US	PE linked (Vanguard)
Sinokor Merchant	10	32.2	South Korea	
SM Group	10	10.1	South Korea	
China Merchants	9	3.8	Hong Kong	
Asyad Shipping	9	16.4	Oman	Energy major linked
Nakilat JC	8	15.1	Qatar	Energy major linked
Chevron	8	7.9	US	Energy major linked
Alpha Tankers	8	3.0	Greece	
Thenamaris	8	9.9	Greece	
Global Meridian	8	0.0	Bermuda	PE linked (JP Morgan)
Apollo Global (Energos)	7	12.4	US	PE linked (Apollo partners)
MOL & CSLNG JV	7		Consortium	Energy major linked
Meiji Shipping	7	10.0	Japan	
Minerva Marine	7	2.0	Greece	
SCF Group	7	9.7	Russia	Energy major linked
Shell	6	25.7	UK	Energy major linked
BP	6	4.7	UK	Energy major linked
Seapeak CLSICO JV	6	4.5	Canada	Energy major linked (Yamal project)
Smart LNG	6		Russia	Energy major linked
Pan Ocean	6	7.6	South Korea	
CLNG	6	13.9	Hong Kong	
CNOOC/CMES/NYK JV	6		Consortium	Energy major linked
CNOOC/CSLNG/MOL JV	6		Consortium	Energy major linked
Tokyo LNG Tanker Co	5	16.0	Japan	Energy major linked (Tokyo Gas)

Source: SFOC, Clarkson

Note: Data as of 15 August 2023

## 7.2 Appendix 2. Change of LNG Shipowners and their Fleet (2014-2023)

	No.					Fleet				
	Shipowners	Energy Major	Energy Major Breakdown		*Total	Shipowners	Energy Major	Energy Major Breakdown		*Total
			Export	Import				Export	Import	
2014	38	40	25	15	78	142	183	159	24	325
2023	57	33	19	14	90	449	201	155	46	650
+/-	50%	-18%	-24%	-7%	15%	216%	10%	-3%	92%	100%

Source: SFOC, Clarkson, World LNG Report 2014 and 2023 (IGU)

Note: \*Total includes the figures of Shipowners and Energy Majors.  
In 2023, a single company was labeled as "unknown." and we categorized it under the classification of "Shipowners."

## 7.3 Appendix 3. New LNG Shipowners in 2023

Shipowners in 2023	Fleet	Category	Background
Alpha Tankers	8	Shipowner	New
Capital Maritime	18	Shipowner	New - PE Linked
Cardiff Marine	24	Shipowner	New
Chandris Group	2	Shipowner	New
China Dev Bank	5	Shipowner	New - Financier
CSSC leasing	4	Energy major - Import	New - Financier
Eastern Pacific Shipping / CoolCo	13	Shipowner	New
Energos	7	Shipowner	New - PE Linked
Excelerate Energy	11	Shipowner	New - PE Linked
Flex LNG	11	Shipowner	New - PE Linked
H-Line	17	Shipowner	New - PE Linked
Hoegh	12	Shipowner	New
Huaxia Bank	1	Shipowner	New - Financier
Hyundai LNG Shipping	17	Shipowner	New - PE Linked
Hyundai Motor Group	2	Shipowner	New
Karadeniz	1	Shipowner	New
KMARIN	1	Energy major - Export	New - Financier
Latsco	2	Shipowner	New
Lepta	1	Shipowner	New
Meiji Shipping	7	Shipowner	New
Minerva Marine	7	Shipowner	New
Navigare Capital	1	Shipowner	New - Financier
New Fortress	1	Shipowner	New - PE Linked
Oceonix Services Ltd	21	Shipowner	New - PE Linked
Pardus Energy	1	Energy major - Import	New
Schulte Group	5	Shipowner	New
Shandong Marine	1	Energy major - Import	New

<b>Shipowners in 2023</b>	<b>Fleet</b>	<b>Category</b>	<b>Background</b>
Sinokor	10	Shipowner	New
Thenamaris	8	Shipowner	New
Trada Maritime	1	Shipowner	New
Tsakos	3	Shipowner	New
Xinhang Shipping	1	Energy major - Import	New
CMES Shipping	8	Energy major - Import	New
Global Meridian	8	Shipowner	New - PE Linked
Hanwha Ocean	3	Shipyard	New
Hyundai Glovis	1	Shipowner	New - PE Linked
TPSH Leasing	2	Energy major - Import	New - Financier
Evalend Shipping	2	Shipowner	New

Source: SFOC, Clarkson, World LNG Report 2014 and 2023 (IGU)