Solutions for Our Climate

CLIMATE ANALYTICS

# High and dry:

## The global energy transition's looming impact on the LNG and oil shipbuilding industry

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Cover photo: DSME shipyard on Geoje island, South Korea. Photo by Panwasin seemala.

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# Executive Summary

The Paris Agreement's goal of limiting the average annual temperature increase above pre-industrial levels to 1.5°C demands that fossil fuel production and consumption declines rapidly and immediately. Both the IPCC and the IEA make it clear the world cannot afford to dig up new fossil fuels, nor build new fossil fuel infrastructure.

In this report we have analysed the outlook for LNG carrier and oil tanker shipbuilding under a suite of future energy consumption and production scenarios, covering a range of global emissions levels and associated long term temperature rises.

Given the expected future decline in fossil fuel use, as the world moves to limit warming to 1.5˚C, it is inevitable that oil tanker and gas carrier shipbuilding will also experience a decline. Moreover, as we show here, a decline in this shipbuilding sector would occur even under policies and actions that limit to warming to 1.7˚C or 2.5˚C.

These ship types accounted for 27% and 10% of new ship builds globally over the period 2016 to 2020. Any decline in the market for these ships will have a significant effect on the sector as a whole.

The objective of this study is to examine the risks faced by the global, and particularly the Korean, shipbuilding industry, in the face of a decarbonising world.

Korea has one of the largest ship building industries in the world, capturing 37% of total global orders in 2022, and holding a dominant position in the industry building both LNG carriers and very large crude oil carriers (VLCC). Korean shipbuilders won 70% of the global orders for large LNG carriers in 2022. In terms of compensated gross tonnage (cgt), LNG carriers accounted for 65% of all the orders won by Korean shipbuilders in 2022.

Korea's shipbuilding sector is heavily dependent on the manufacturing of oil tankers and LNG carriers, and is therefore likely to face a fundamental crisis. As ships have consistently ranked among the country's top ten exports in terms of value, a crisis in shipbuilding will have adverse effects on the country's wider economy.

Globally, LNG carriers have played an increasingly important role in the natural gas export market. The share of natural gas traded via LNG carriers increased from 27% in 2000 to 51% in 2021. LNG trade accounted for 76% of the growth in total natural gas trade over the period. It is therefore likely that any future growth in natural gas trade, and consequently consumption, will depend critically on the building of new LNG carriers. Conversely, a decline in natural gas consumption will likely be particularly detrimental to the LNG carrier shipbuilding industry.

## Findings

- Our analysis of the IEA's NZE, a scenario consistent with the Paris Agreement's long term temperature goal, shows that limiting global temperature increase to 1.5°C requires that no new oil tankers and LNG carriers be built. There is a serious risk of stranded assets for the hundreds of LNG carriers currently on order.

- The IEA's scenarios based on government policies (STEPS) and adopted pledges (APS), while leading to global warming of 2.5°C and 1.7°C respectively, and therefore inconsistent with the 1.5°C long term temperature goal, also see a large decline in demand for global LNG carrier and oil tanker shipbuilding.

- As the world moves to implement the Paris Agreement, countries with large LNG carrier and oil tanker shipbuilding sectors, namely Korea, China, and Japan, but other countries as well, face significant risk if they fail to respond to and plan for the global energy transition.

- Not only do the shipbuilders face economic risks, but so do the owners. Investors and governments who subsidize new gas projects should consider the longer-term outlook for fossil fuels and the implications for stranded asset risk.

- Given their vast resources and expertise, Korea, and other large public financiers of fossil fuels, are well placed to be leaders in this renewable energy transition. Emerging opportunities in offshore wind development and green hydrogen are particularly relevant for the transition of the shipbuilding industry.

- To take advantage of these opportunities, Korea and other shipbuilding countries could redirect public finance currently subsidising fossil fuels, including shipbuilding activities, towards renewable energy. Doing so would allow them to avoid stranded asset risk and deliver a just transition for its shipbuilding industry.

# Table of Contents



# Table of Figures



# Table of Tables

# Introduction

As the world moves to implement the Paris Agreement, a scientific consensus has been reached that the expansion of fossil fuel production and use is inconsistent with the goal of limiting the average annual temperature increase to 1.5°C above pre-industrial levels. Moreover, current levels of fossil fuel production and consumption will have to decline immediately and rapidly to achieve the emission reductions that governments have agreed to. In 2021, the International Energy Agency (IEA), published a report which concluded that under a pathway for global net zero energy-related carbon emissions by 2050, there would be no need for investment in new fossil fuel supply or LNG infrastructure (IEA 2021).

The recently-released synthesis from the IPCC's Sixth Assessment Report (AR6) is unequivocal: limiting warming to 1.5°C would require global carbon emissions to drop by around half of 2019 levels by 2030 and reach net zero by 2050[1]. Given this, future $CO_2$ emissions from existing fossil fuel infrastructures already exceed the remaining carbon budget for limiting warming to 1.5°C (IPCC 2023).

The urgency of the climate crisis demands that public financial institutions stop funding fossil fuel projects. Financing the extraction, transportation, and processing of fossil fuels will not only lead to delays and increased costs for the necessary energy system transition, but also leave those financial institutions holding stranded assets.

At COP26 in Glasgow, 2021, 34 countries and five public finance institutions signed a joint commitment (formally the "Clean Energy Transition Partnership") to end international public finance (IPF) for fossil fuels by the end of 2022 and instead prioritise public finance for clean energy (IISD et al. 2022). A near-identical commitment was adopted at the 2022 G7, bringing Japan, one of the world's largest fossil fuel financiers, on board (OCI and FOE 2022). South Korea, the third largest financier of fossil fuels globally and not a G7 member, did not sign onto the Clean Energy Transition Partnership.

Korea provided an average of around USD 10.8bn per year of public finance for fossil fuels between 2018 and 2020. Of this, 87% (around USD 9.4bn per year) went to oil and gas, the rest for coal (around USD 1.4bn per year) (OCI and FOE 2021). As of 2021, Korea remains the third largest provider of public fossil fuel financing among G20 countries (OCI and FOE 2022). Renewables, by comparison, received only around USD 0.62 bn per year over the 2018-2020 period. In total, Korea's three major public financiers (Export-Import Bank of Korea, Korea Trade Insurance Corporation, and Korea Development Bank) provided about USD 127bn to the oil and gas industry between 2011 and 2020. Of

1 Global modelled emissions pathways that limit warming to 1.5°C with a greater than 50% likelihood and no to limited overshoot have net CO2 emissions declining by 48% [36%-69%] from 2019 levels by 2030 and 99% [79%-119%] from 2019 levels by 2050 (IPCC 2023).

this, 46% went towards the construction of offshore oil and gas plants and oil and gas related shipbuilding (SFOC 2021).[2]

Korea has one of the largest ship building industries in the world, capturing 37% of total global orders in 2022. The country holds a dominant position in relation to building both LNG carriers and very large crude oil carriers (VLCC). Korean shipbuilders won 70% of the global orders for large LNG carriers in 2022. In terms of compensated gross tonnage (cgt), LNG carriers accounted for 65% of all the orders won by Korean shipbuilders in 2022 (MOTIE 2023).

Globally, LNG carriers have played an increasingly important role in the natural gas export market. The share of natural gas traded globally via LNG carriers increased from 27% in 2000 to 51% in 2021. LNG trade accounted for 76% of the growth in total natural gas trade over the period.[3] It is therefore likely that any future growth in natural gas trade, and consequently consumption, will depend critically on the building of new LNG carriers. Conversely, a decline in gas consumption will likely seriously affect future prospects for the LNG carrier shipbuilding industry.

Tankers have a long history in the transportation of crude oil and refined petroleum products. Although pipelines, road, and rail play a significant role in oil movements globally, tankers remain the dominant method for transporting oil and its derivatives. Crude oil transport by tanker accounted for around 51% of all oil trade in 2021. Refined petroleum products (excluding LNG) accounted for around 24%.[4] Tankers' share in crude oil and refined product (excluding LNG) transport has decreased steadily from 92% in 2000. Nonetheless, future growth in oil trade and consumption will likely depend heavily on the building of new tankers and, as is the case with LNG, a decline in oil consumption will be detrimental to the oil tanker shipbuilding industry.

While the urgency of limiting temperature rise to 1.5°C will require a rapid and deep reduction in oil and gas consumption, and related shipbuilding, recent events have resulted in some moves in the opposite direction. The Russian invasion of Ukraine, beginning in February 2022, has led to major changes in the global market for natural gas.

2 Over the period 2011 to 2020, USD 57.7bn in public finance was provided to Korea's shipbuilding sector for oil and gas related activities. Of this, USD 23.1bn and USD 14bn was used for building natural gas carriers and oil tankers respectively. (SFOC 2021).

3 According to the 2022 BP Statistical Review, LNG trade increased from 140.5 bcm to 516.2 bcm over the period 2000 -2021. During this time, overall natural gas trade increased from 527.8 bcm to 1021.9 bcm. (BP 2022).

4 Total global oil trade is taken from the 2022 BP Statistical Review, which is given in thousand barrels daily (BP 2022). Seaborne trade of crude oil and refined petroleum products is taken from UNCTAD Stat, which uses units of million tonnes (UNCTAD 2022a). The two sources are compared using the conversion 7.33 barrels of crude oil per tonne (see Appendix C of (Wittcoff et al. 2013)). LNG has been excluded from UNCTAD's refined petroleum product data by subtracting LNG trade values taken from BP Statistical Review, converting units as appropriate.

Concerns around energy security and Europe's shift from Russian pipeline gas towards LNG imports have led to a push to open new oil and gas fields, build additional LNG import terminals, and record-breaking orders for new LNG carriers. However, it is not likely that current drivers of growth in the LNG market, namely European demand and US supply, will continue to do so beyond the short-term (IEA 2023).

Long-term outlooks see a decline in fossil fuel consumption. Already, high prices have led to fuel switching and reduced demand for natural gas in Europe and throughout Asia, particularly in China. More importantly, ongoing policy support for renewables, particularly wind and solar, and increased energy efficiency are structural drivers of reduced demand for fossil fuels generally, and natural gas specifically (Zeniewski et al. 2023). This forecast decline in fossil fuel use is seen across all IEA scenarios, as shown in Table 1.

In its latest global energy assessment, the IEA tells us that "lasting solutions to today's crisis lie in reducing fossil fuel demand. Much more emphasis is needed on goals and plans for scaling up investment in clean energy transitions, and on what governments can do to incentivise this." To be sure, the IEA is referring here not only to the ongoing environmental crisis of climate change, but also to the current crises of energy security and price volatility resulting from Russia's invasion of Ukraine.

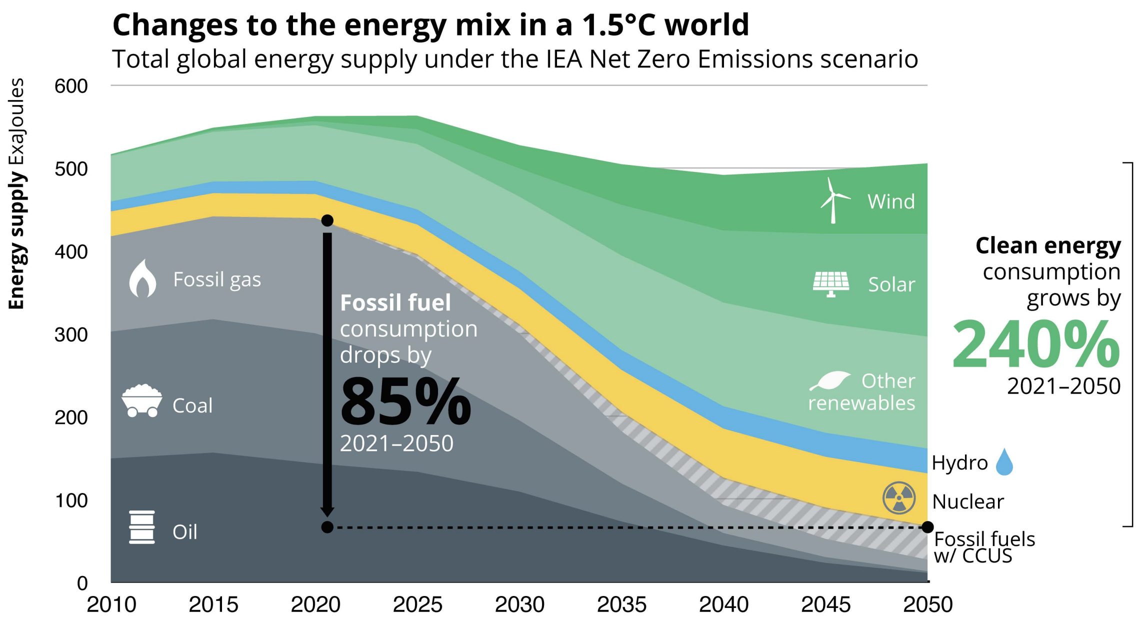


*Figure 1: Global total energy supply (EJ), historic and forecast under the IEA NZE*
*Source: (IEA 2022)*

A global reduction in fossil fuel use is inevitable and the pace of this decline, and corresponding increase in renewable energy use, will strongly determine the level of global temperature rise. Table 1 gives an overview of the changes in future global total energy supply from IEA scenarios which are based on the goal of achieving net zero carbon emissions from the global energy sector by 2050 to limit global warming to 1.5°C (NZE) and on current government policies and pledges (STEPS and APS respectively). Each of these scenarios is associated with a given average annual temperature rise above pre-industrial levels. As shown in Table 1, and illustrated in Figure 1, limiting temperature increase to 1.5°C will require an immediate and rapid transition from fossil fuels to renewables. Even under the STEPS scenario, which would see an expected temperature increase of 2.5°C, and thus not meet the goals of the Paris Agreement, fossil fuel use would decline.

Given the expected decline in fossil fuel production and use, particularly as the world moves to implement the Paris Agreement, it is inevitable that oil tanker and gas carrier shipbuilding will also experience a decline. These ship types accounted for 27% and 10% of new ship builds globally over the period 2016 to 2020.[5] Thus, any decline in the market for these ships will have a significant effect on the sector as a whole.

*Table 1: Change, relative to 2021 levels, in renewable and fossil fuel share of global total energy supply (EJ).*

| Scenario | Est. Temp increase | Fuel type | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| **NZE** Net Zero Emissions by 2050 scenario | **1.5°C** | Renewable | 76% | 213% | 281% |
| | | Fossil | -33% | -73% | -86% |
| **APS** Announced Pledges scenario | **1.7°C** | Renewable | 54% | 151% | 231% |
| | | Fossil | -12% | -37% | -54% |
| **STEPS** IEA's Stated Policy scenario | **2.5°C** | Renewable | 39% | 91% | 137% |
| | | Fossil | -1% | -6% | -10% |

*Source: (IEA 2022). Renewable category includes solar, wind, hydro, modern bioenergy, and traditional biomass. Fossil fuel category includes natural gas, coal, oil, and fossil fuels with carbon capture utilisation and storage (CCUS).*

Korea's ship building sector, which is heavily dependent on the manufacturing of oil tankers and LNG carriers, is likely to face a fundamental crisis. As ships have consistently ranked among the country's top ten exports in terms of value, a crisis in shipbuilding will have adverse effects on the country's wider economy.

The objective of this study is to examine the transition risks faced by the global, and particularly the Korean, ship building industry as the world moves to implement the Paris Agreement.

5 See previous annual publications of UNCTAD Review of Maritime Transport. For example (UNCTAD 2022b).

# Overview of the oil tanker and gas carrier market

Maritime shipping of oil and gas has grown significantly in the past two decades. This is particularly the case for Liquified Natural Gas (LNG). While the amount of oil traded grew by 46% between 2000-20, LNG trade grew a whopping 249%.[6] Figure 2 shows the historic trend in LNG trade up to 2020. Also included are trade forecasts from the IEA's Stated Policy (STEPS), Announced Pledges (APS), and Net Zero Emissions by 2050 (NZE) scenarios.

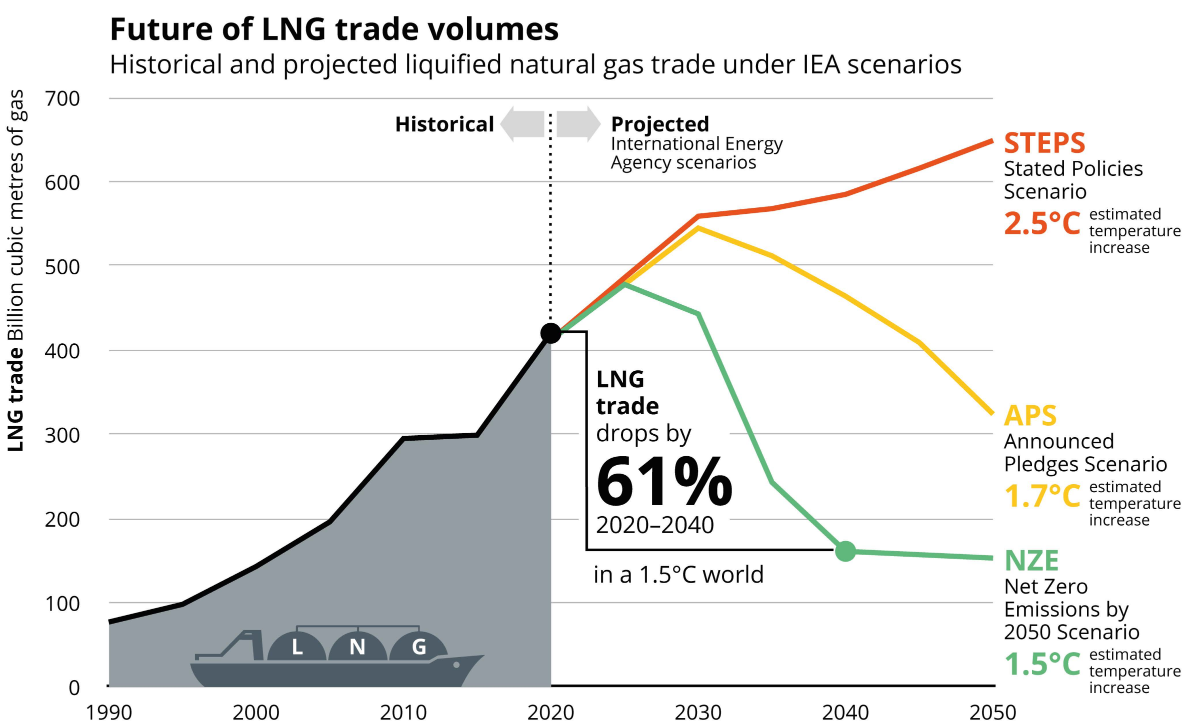


*Figure 2: Global LNG trade, historic and forecast under various IEA scenarios. Source: (IEA 2022) (IEA 2022, 2021).*

In line with the historic growth in LNG exports has come a corresponding growth in LNG shipping capacity.[7] Figure 3 shows annual new shipping capacity delivered (i.e., new ship builds) over the period 2000-2021. Historically, Korean shipbuilders (namely the 'big three': Hyundai Heavy Industries (HHI), Samsung Heavy Industries (SHI), and Daewoo Shipbuilding and Marine Engineering (DSME)) have delivered the vast majority of new LNG shipping capacity, as can be seen in Figure 3.[8]

6 Oil trade grew from 32.6 to 64.9 million barrels daily, while LNG trade grew from 141 to 490 billion cubic meters over the 2000-2020 period (BP 2022).

7 Clarksons provides data on LNG carriers including the year in which they were built and their capacity (in units of million cubic metres of LNG).

8 Note that Japan seemingly exited from LNG shipbuilding in 2020. This was due to then lower prices for LNG ships which made the relatively high-cost shipyards in Japan uncompetitive with those in Korea and China. However, Japanese shipbuilders have retained their capacity and experience in this area and the recent increase in demand, and consequent higher prices, may entice Japanese shipbuilders to recommence building LNG ships.(Cygnus Energy 2022)

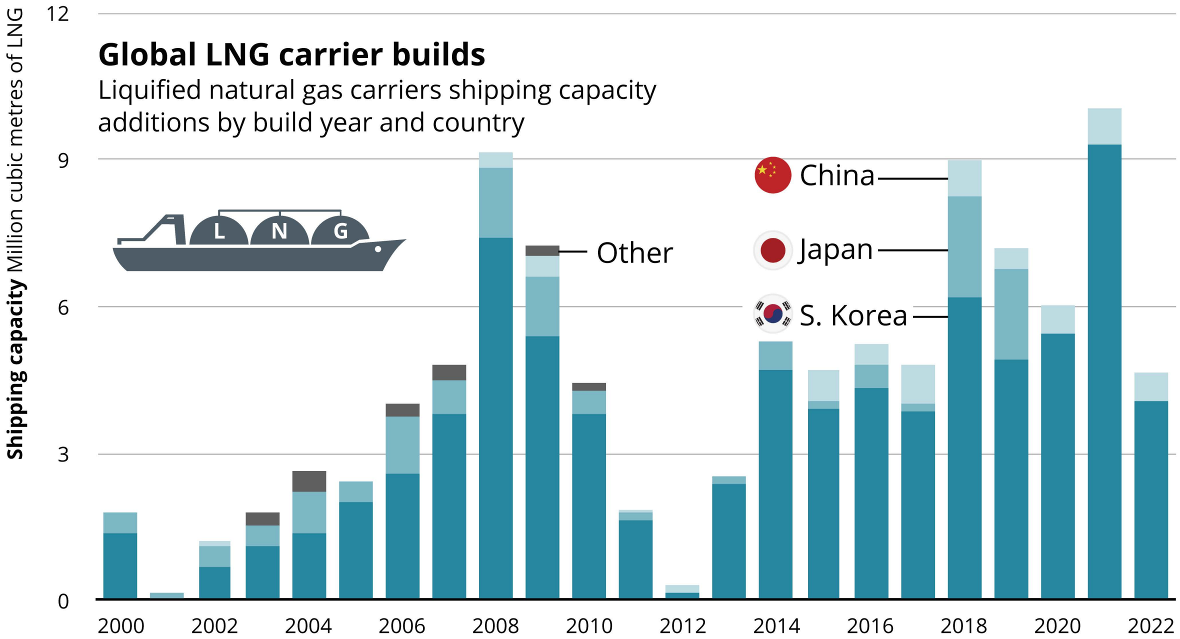


*Figure 3: New LNG shipping capacity by year of delivery and origin. Source: Clarksons.*

Oil tanker shipbuilding trends differ from that of LNG in two important ways for our study. First, the market for oil tankers is more diverse on the supply side. While Korea still holds a dominant position (the country has won close to 60% of all oil tanker new build orders in the last ten years, in terms of dead weight tonnage), China and Japan have relatively larger shares in annual output when compared to LNG shipbuilding (as shown in Figure 4).

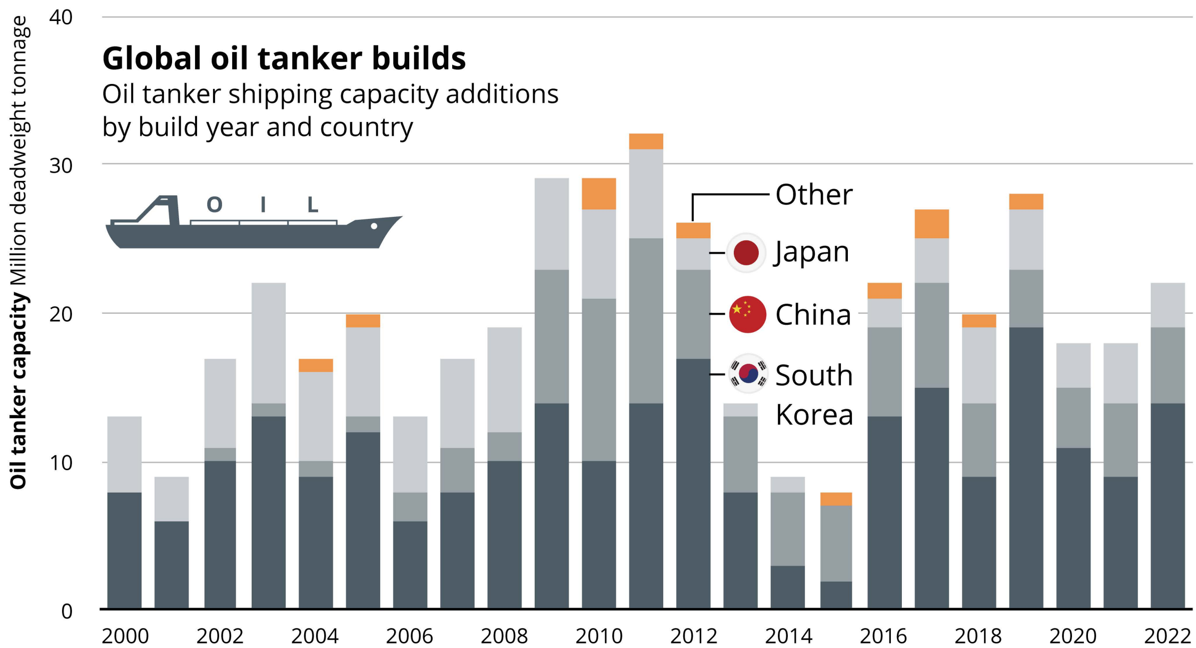


*Figure 4: Oil tanker new builds by year of delivery and origin. Source: Clarksons*

Second, a downward trend in orders for new builds has been observed in recent years, with a significant decline in 2022 (Hellenic Shipping News 2023). This is a striking difference from the upward trend in orders for LNG carriers. The low demand for new oil tankers is likely to persist this year, partly due to the effects of Russia's invasion of Ukraine over the short, and perhaps, medium term: shipbuilders are preferring to take on orders for higher-priced LNG carriers and thus leaving few slots open for oil tanker builds.

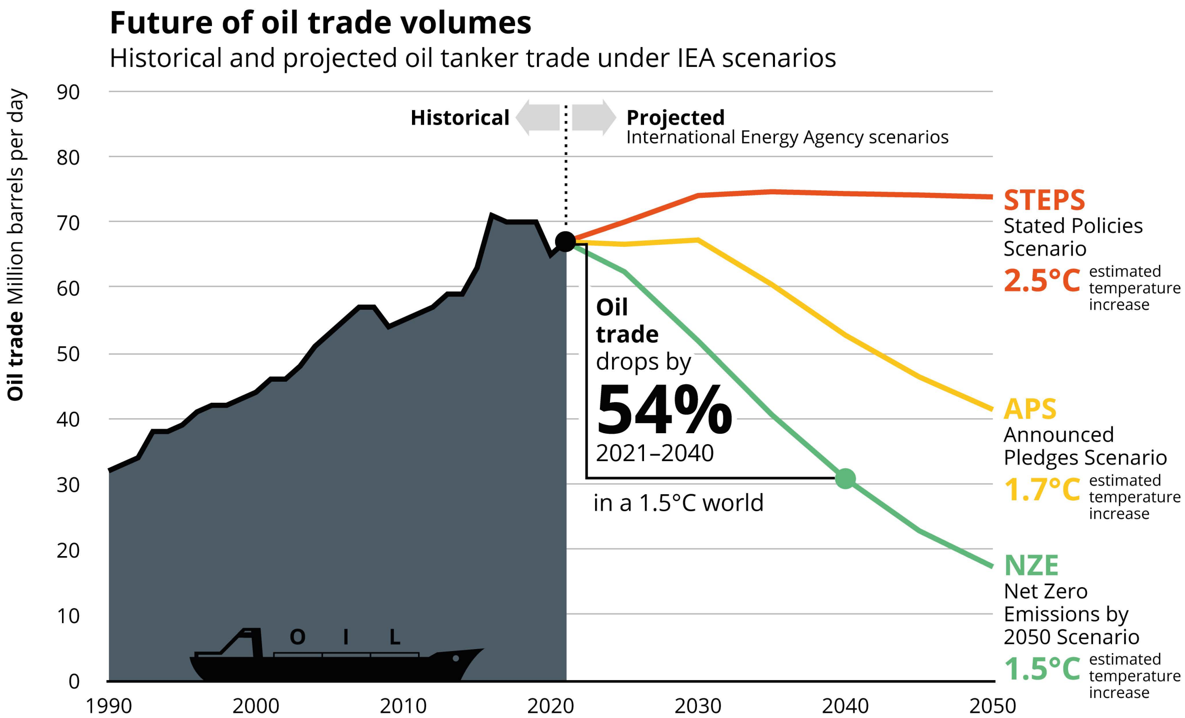


*Figure 5: Global oil trade, historic and forecast under various IEA scenarios.*
*Source: (IEA 2022; BP 2022)*

However, over the longer term, climate regulations from the International Maritime Organisation and the European Union are set to change the requirements for new oil tankers, and, anticipating this, owners have been somewhat reluctant to place new orders (Council of the EU 2023; IMO 2022).

The long term forecast for oil trade from the IEA shows a sharper decline across scenarios when compared with LNG trade, as can be seen in Figure 5. The change in trade for both fuels, with respect to 2020 levels, under the three IEA scenarios is shown in Table 2.

*Table 2: Change in oil and LNG trade under IEA scenarios, with respect to 2020 levels.*
*Source: (IEA 2022)*

| Scenario | LNG | | Oil | |
|---|---|---|---|---|
| | 2030 | 2050 | 2030 | 2050 |
| NZE | 5% | -64% | -23% | -74% |
| APS | 30% | -23% | 0% | -38% |
| STEPS | 33% | 54% | 11% | 10% |

# Upcoming challenges for the oil tanker and gas carrier market

It is well understood that climate change mitigation in line with the goals of the Paris Agreement will require a rapid and deep reduction in fossil fuel use. The latest IPCC assessment tells us that expected future emissions from existing fossil fuel infrastructure exceed the global carbon budget for limiting warming to 1.5°C (IPCC 2023). This means that Paris Agreement compatibility will not only require that no new fossil fuel infrastructure be built, but that concerted efforts must be made to phase out the existing infrastructure. Similar conclusions have been reached by academics (Trout et al. 2022; Welsby et al. 2021) and international organisations (IEA 2021; SEI et al. 2021).

The IEA regularly releases forecasts of future energy consumption and production. As mentioned earlier, particularly relevant for this study are its scenarios based on the requirements of the Paris Agreement (NZE), government pledges (APS), and government policies (STEPS). The IEA has assessed that the associated carbon emissions under these scenarios will result in global median surface temperature rises of below 1.5°C, 1.7°C, and 2.5°C above pre-industrial levels by 2100 for the NZE, APS, and STEPS respectively (IEA 2022).

An independent assessment of institutional decarbonisation scenarios has found that the NZE falls into the category of 1.5°C compatible pathways with low-overshoot (meaning that temperature increase in this scenario will be slightly above 1.5°C mid-century, but remain below 1.5°C by 2100) (Brecha et al. 2022).

## LNG carriers

As we have seen, LNG shipbuilding constitutes an increasingly significant portion of global, and particularly Korean, shipbuilding output. LNG trade activity will likely play a decisive role in future global emissions pathways. It is therefore important to understand LNG trading forecasts and how this might affect the future LNG shipbuilding market.

We have developed scenarios for future LNG shipping capacity requirement based on IEA scenarios. As we saw in Figure 1, the NZE scenario forecasts that LNG exports will peak in around 2025 and decline rapidly out to 2050, abruptly reversing the sharp increase in LNG trade seen between 1990 to 2020.

In line with the historic growth in LNG exports has come a corresponding growth in LNG shipping capacity. Clarksons provides data on LNG carriers including the year they were built and their capacity (in units of million cubic metres of LNG).

At the end of 2021, there were around 700 ships in the global LNG fleet, including LNG carriers, Floating Storage and Regasification Units (FSRU), and LNG bunkering vessels. The median capacity of ships in the fleet is 160,000 cubic metres of LNG. The fleet is relatively young. Given an average ship lifetime of 35 years, this means the existing LNG fleet will not see significant loss of capacity until around 2040.

Another 34 LNG carriers were added to the global fleet in 2022 with a median capacity of 174,000 cubic metres. A further 335 LNG carriers, of this same median capacity, are set to be delivered between 2023 and 2028.

An important metric to examine is LNG shipping capacity utilisation: the ratio between LNG ship capacity in operation and the amount of LNG traded in a given year. The ratio was generally in decline between 2000 and 2009. This was due to LNG shipping capacity growing at a higher rate than LNG exports. Since then, the ratio has become relatively stable around a median value of around 5.5 billion cubic meters (bcm) of gas traded per million cubic metres of LNG shipping capacity. We can use this metric to determine the amount of shipping capacity required under the IEA forecast.

The IEA provides forecast values at five and ten-year intervals past 2021 and out to 2050. We assume a linear path for intervening years. To derive shipping capacity requirements from trade forecasts, we assume that, out to 2050, the ratio between imported LNG and shipping capacity stays at the median level seen over the last decade.

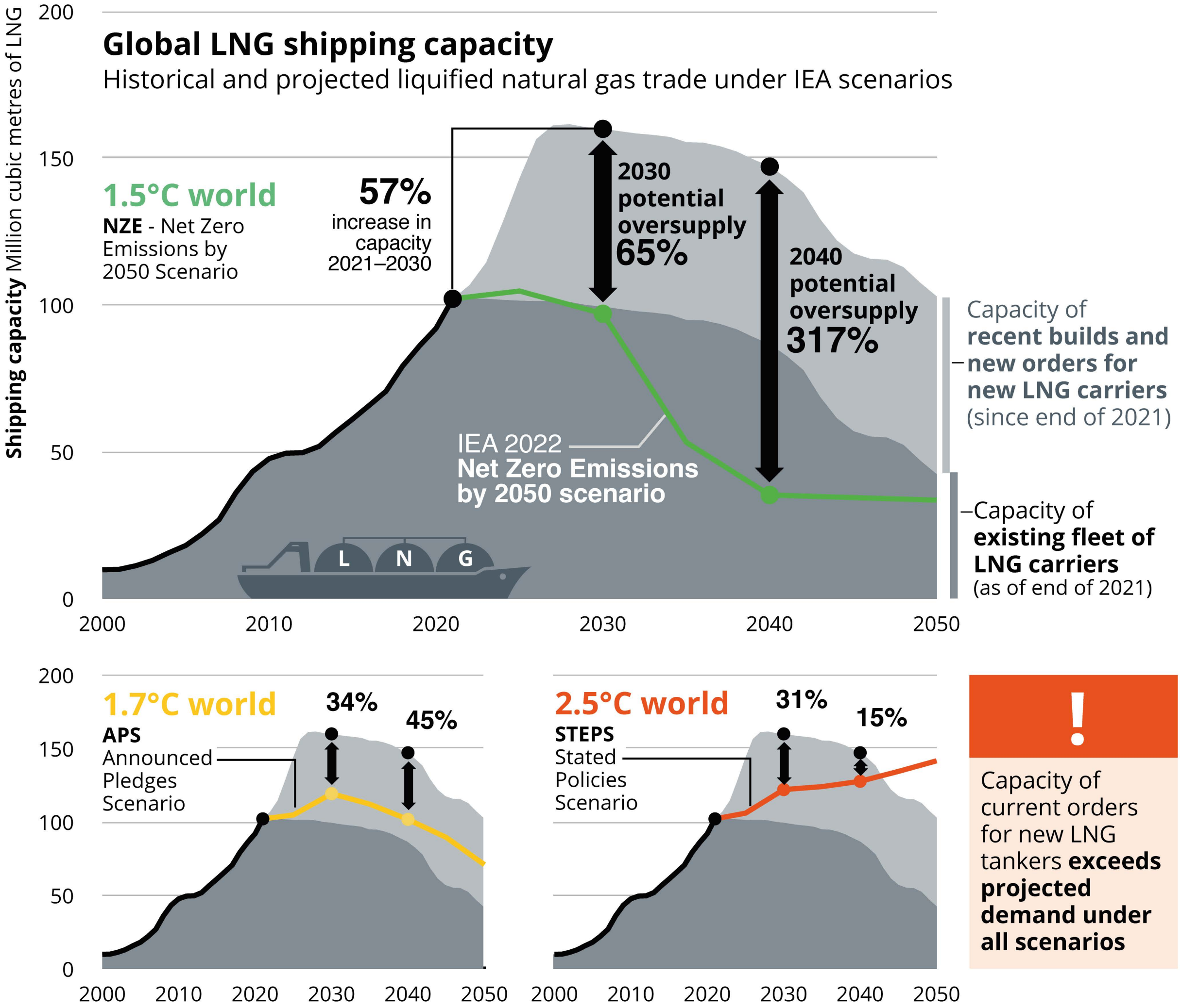


*Figure 6: Global LNG shipping capacity, historic and forecast.*
*Source: (IEA 2022), Clarksons*

Having derived to demand-side forecasts, we next look at the supply side. Here we take the data for LNG ship fleet in operation and on order as per the Clarksons data. We have examined shipping capacity available in two ways. First, the likely LNG shipping capacity available had no new ships been built after 2021.[9] Second, the likely shipping capacity available including ships built in 2022 and on order to be built between 2023 and 2028. For both supply side forecasts, we assume full capacity availability (e.g., no ships are laid up for repairs) and that ships are retired after 35 years. The resulting demand and supply side forecasts are shown in Figure 6.

As shown, the IEA's NZE forecast for LNG trade suggests that, after 2021, no new LNG shipping capacity was needed to cover LNG shipping requirements out to 2050. Even if no new carriers had been built after 2021, there would have been a large amount of over supplied capacity past 2030.

However, new LNG carriers were built in 2022 and, due to the upsurge in orders over the last two years, hundreds more are set to be delivered between 2023 and 2028.[10] Taking these into account, the available LNG shipping capacity surpasses not only what is required under the NZE, but also that under the APS and STEPS.

Table 3 shows the average annual excess LNG shipping capacity above what is required under the three IEA scenarios. These values can be compared to the total LNG shipping capacity at the end of 2021, 102 million cubic meters. As shown in Figure 6, LNG shipping capacity, given ships currently in operation and on order, will peak in 2028. At that point, capacity in excess of NZE requirement will be around 61 million cubic meters, which would equate to roughly 370 ships.[11] However, given the NZE's rapid decline in LNG trade past 2030, the oversupply would continue to increase, reaching 112 million cubic meters in 2040, or around 678 ships.

*Table 3: Average annual oversupplied LNG shipping capacity (million cubic meter), relative to requirements under IEA scenarios, given current LNG orderbook.*

| Scenario | 2022-2030 | 2031-2040 | 2041-2050 |
|---|---|---|---|
| **NZE** | 41.9 | 98 | 86.1 |
| **APS** | 34.4 | 44.2 | 34.1 |
| **STEPS** | 32.9 | 29.9 | -14.8 |

9 We have chosen to examine likely shipping capacity, with no new builds, as of the end of 2021 as to compare with the IEA scenarios where LNG trade is forecast starting from 2022. It is also important to note that the NZE scenario was initially released in 2021, and the associated report stated that there would be no need for investment in new fossil fuel supply as of that year (IEA 2021).

10 According to Clarksons, globally, there were 81 and 180 LNG carriers ordered in 2021 and 2022 respectively. These were historically the highest number of orders placed for a given year, with the number of orders placed in 2022 being six times greater than the median value seen between 2000-2020 (i.e., 30).

11 Given an average shipping capacity of 0.165 million cubic meters per ship, around the median value of ships built or on order to be delivered from 2020 onward.

Note that although the forecast supply of shipping capacity falls below what is required under the STEPS in the early 2040s, this is under the assumption that shipping capacity utilisation remains close to current levels. The forecast fleet could easily accommodate demand under STEPS given slightly higher utilisation rates in the 2040s.

The LNG shipping industry faces a significant risk that even recently-built carriers will become stranded assets in the near to medium term future. Yet, far from taking steps to mitigate these risks, the industry has doubled down and seeks to increase shipping capacity to a level that starkly contradicts what the Paris Agreement requires.

## Oil tankers

We have conducted a similar scenario analysis for global oil trade by tanker. Here we have taken historical data on oil tanker capacity from Clarksons. Forecasts for future oil production under the IEA STEPS, APS, and NZE have been applied to historic oil trade data from BP to determine future oil trade scenarios. These oil trade forecasts are then converted to oil tanker capacity requirements for each scenario. The results are shown in Figure 7.

The forecasts of oil tanker capacity assume that:

- Oil tanker capacity in a given year is the sum of 100% of capacity of ships built 20 years prior to given year and 50% of capacity of ships built between 21 and 30 years prior to given year.
- Oil tanker capacity in terms of million barrels of oil is converted from dead weight tonnage (DWT) assuming that 90% of DWT is used for oil cargo and using a barrel per metric tonne conversion of 7.33, this being the conversion factor for crude oil.[12]
- The no new builds scenario assumes no new oil tankers are built beyond what is currently on order.
- The capacity requirement forecasts based on IEA scenarios assume that the utilisation rate of oil tankers remains at the level seen in recent years, around six barrels traded per barrel of fleet capacity in operation.

Figure 7 tells a similar story to the results of our LNG shipping scenario: under a 1.5°C global pathway, demand for oil tankers would sharply decline. That is, the decline in oil tanker capacity, assuming no new builds aside from those currently on order, most closely follows the decline in oil trade forecast under the NZE. The NZE-based scenario seems to suggest that, with no new oil tankers built, a shortfall in shipping capacity may occur starting from 2040. However, this shortfall is based on the above assumptions on ship lifetime, and slightly longer lifetimes could make up for it.

12 Please see Appendix C of (Wittcoff et al. 2013).

It is also important to consider oil tanker utilisation, the ratio of total oil traded to total oil tanker fleet capacity. This ratio has stood around 6 barrels traded per barrel of fleet capacity in operation in the last few years. However, between 1990-2010, the ratio was closer to 8 barrels traded per barrel of capacity. Oil tanker utilisation ratio would need to increase to those previously seen, or higher, levels past the mid-2040s if the current and on order fleet is to fulfil the oil demand under the NZE.

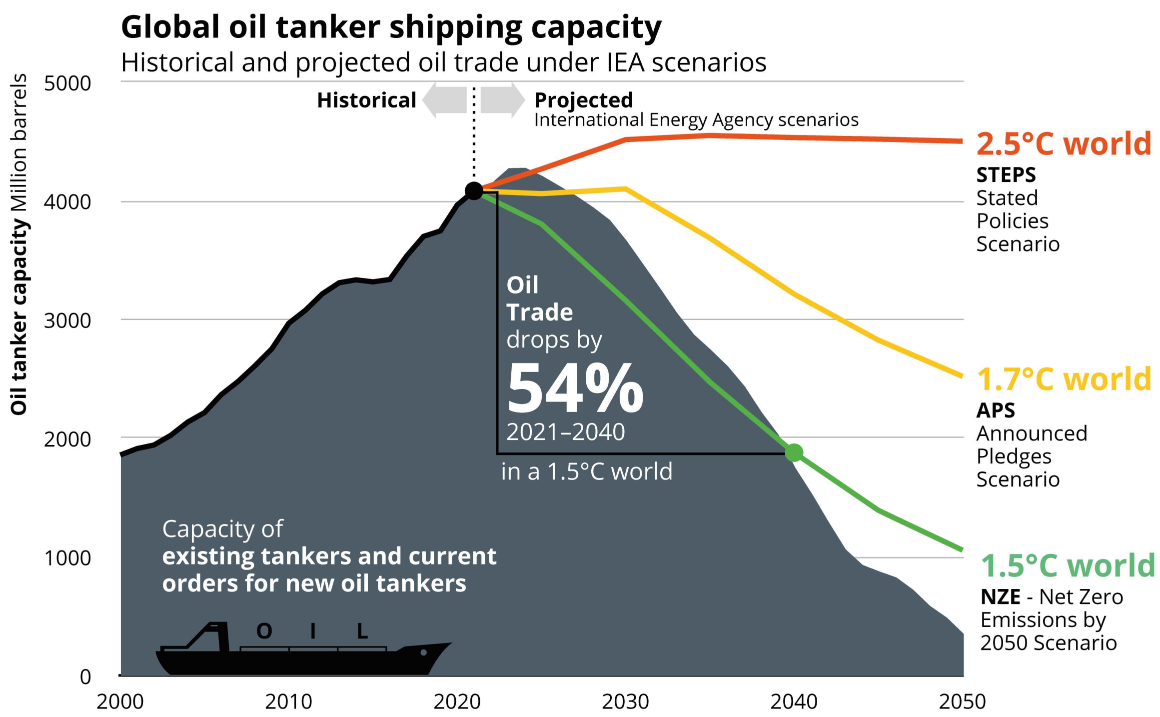


*Figure 7: Global oil tanker capacity, historic and forecast.*
*Source: (IEA 2022), Clarksons*

Over the last 20 years, Korean shipbuilders have delivered around 50% of the oil tankers delivered in a given year. Compared with LNG ships, Korean shipbuilders hold less of the oil tanker market share and would likely face greater competition to win new orders. This also implies that shipbuilders from China, Japan and other countries, as well as their governments and the associated supply and financial sectors, share a greater part of the stranded asset risk and should address this problem as urgently as Korea.

# Conclusion

The Paris Agreement's goal of limiting the average annual temperature increase above pre-industrial levels to 1.5°C demands that fossil fuel production and consumption decline rapidly and immediately. Reports from the IPCC and IEA make clear that the world cannot afford to build out new fossil fuel infrastructure, including oil tankers and LNG carriers.

In this report we have analysed the outlook for LNG carrier and oil tanker shipbuilding under a suite of future energy consumption and production scenarios covering a range of global emissions levels and associated long term temperature rises.

Our analysis of the IEA's NZE, a scenario consistent with the Paris Agreement's long term temperature goal, shows that **limiting global temperature increase to 1.5°C requires that no new oil tankers and LNG carriers be built**. However, as we have also shown, there has been a significant upsurge in LNG carrier orders over the last two years. Our analysis of the NZE makes clear, the owners and financiers of LNG carriers will face significant stranded asset risks as the world moves to implement the Paris Agreement.

The IEA's scenarios based on government policies (STEPS) and adopted pledges (APS), while leading to global warming of 2.5°C, resp. 1.7°C, and therefore inconsistent with the 1.5°C long term temperature goal, also see a large decline in demand for global LNG carrier and oil tanker shipbuilding.

For oil tankers, while some new shipping capacity may be required, the annual delivery of new ships necessary to meet this requirement will be significantly lower than what has been observed in past years. For LNG carriers, the current shipbuilding orderbook is set to severely oversupply the market.

**As the world moves to implement the Paris Agreement, countries with large LNG carrier and oil tanker shipbuilding sectors, namely Korea, China, and Japan, but other countries as well, face significant risk if they fail to respond to and plan for the global energy transition.**

Not only do the shipbuilders face economic risks, but so do the owners. New projects such as Mozambique LNG, Qatar's North Field Expansion, Australia's Barrossa Gas Project, and others, are driving current demand for LNG carrier newbuilds largely based on myopic assessment of high gas prices. Investors and governments who subsidize these projects should consider the longer-term outlook for fossil fuels and the implications for stranded asset risk.

The IEA's forecasts reflect a widely held view that the global energy transition will see a massive and accelerated rollout of renewable energy. Given their vast resources and expertise, Korea, and other large public financiers of fossil fuel, are well placed to be leaders in this renewable energy transition. Emerging opportunities in offshore wind development and green hydrogen are particularly relevant for the transition of the shipbuilding industry.

To take advantage of these opportunities, **Korea and other shipbuilding countries could redirect public finance currently subsidising fossil fuels, including shipbuilding activities, towards clean energy. Doing so would allow them to avoid stranded asset risk and deliver a just transition for its shipbuilding industry**.

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