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LNG FREIGHT RATE ESTIMATES – Results

A study commissioned by ACCC

EXPERTS WITH IMPACT™

FTI CONSULTING™

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1. Introduction and executive summary

1.1. Context and purpose of this report

1. The Australian Competition and Consumer Commission (ACCC) publishes LNG netback prices to help Australian market players assess the indifference price of gas for consumption in the East Coast Gas Market in comparison to the price that producers would get if they exported this gas to Asia, the main export market for Australian LNG.[1]

2. In response to changes in LNG export markets, such as an increase in global LNG liquefaction capacity, the ACCC reassessed the LNG netback price series in 2021. The ACCC made the decision to supplement its netback reporting by publishing forward LNG netback prices for a period of up to five years in the future. Therefore, in order to determine these longer-term forward LNG netback prices, the ACCC requires estimates of LNG freight rates up to five years in the future.

3. Economic consultancy FTI Consulting (FTI) was selected by ACCC to provide medium-term LNG freight rate estimates based on modelling of the LNG shipping market.

4. The objective of this report to the ACCC is to provide the estimated medium-term LNG freight rates and the full costs of shipping of LNG from Gladstone, Australia, to Tokyo, Japan, for the next five years.

5. The computation of these results is based on an FTI Consulting methodology report dated 9th of August 2022 provided to the ACCC, following an open consultation in July 2022.

1.2. Executive summary

6. In this report, we present estimates of LNG freight rates for the period 2022-2028 for four different propulsion engine technologies: ST, DFDE/TFDE, ME-GI, and XDF, and the results of the LNG shipping prices from Gladstone to Tokyo based on medium-term freight contracting. The estimates are based on an LNG shipping supply/demand model that computes an annual LNG shipping equilibrium price, providing an opportunity cost estimate for 2022 to 2028 (see box 1 below). This report is an update of the Results Report delivered to the ACCC on 29th August 2022.

[1] Source: ACCC, Gas inquiry 2017-2025, https://www.accc.gov.au/regulated-infrastructure/energy/gas-inquiry-2017-2025/lng-netback-price-series

Box 1: Methodology to estimate medium-term LNG freight rates[2]

FTI Consulting's fundamental LNG shipping model is based on the simulation of the equilibrium between supply and demand of LNG transport. It estimates:

1) the demand for LNG transport, that is the quantity of LNG transported by unit of distance

2) the supply of LNG transport, that is the capacity of LNG carrier vessels to transport LNG quantities over the water.

Both demand and supply are estimated over a period of one year, using a measurement of the volume of LNG being carried (ton), and the distance sailed (nautical mile) for the shipment. The product of these dimensions (ton.mile) is the scale of shipping services effectively provided.

In order to estimate the LNG shipping demand, we establish the LNG transport origins and destinations.

To geographically distribute LNG molecule supply and demand, we rely on planned liquefaction and regasification capacities and historical patterns of utilisation. Once LNG molecule origins and destinations have been defined, we run a dispatch optimization model to determine the flows of LNG from origins to destinations minimizing the total cost to transport LNG. This determines the total annual LNG shipping demand, in ton.mile.

This provides us with an LNG shipping demand curve that we can match to an LNG shipping supply curve.

Based on the existing fleet of LNG vessel carriers, and the confirmed order book of future LNG vessels, we determine for each vessel the capacity (ton.mile) to transport LNG and the associated variable costs to provide such services. The variable costs of service for every LNG carrier vessel is the sum of the fuel costs, port fees, boil-off gas costs, other costs, and the part of the freight rate that is not sunk, i.e. the operations and maintenance costs.

The technical characteristics of every vessel (speed, OPEX, fuel consumption, size etc.) are considered to establish each vessel's capacity and associated variable cost to operate, and from that, determine a merit order of LNG carriers' vessels that form our LNG shipping supply curve.

FTI Consulting's model quantifies the annual equilibrium price, in US$/ton.mile, that results from the intersection of the LNG shipping demand and supply curves, as determined above. From this

[2] See the ACCC website for a full explanation of FTI's methodology https://www.accc.gov.au/system/files/FTI%20methodology%20discussion%20paper%20-%20LNG%20freight%20rate%20estimates%20-%2029%20June.pdf

price of LNG transport in US$/ton.mile, we determine for different types of LNG vessels the residual LNG freight rate, as the difference between the equilibrium LNG transport price and the other variable charges of the LNG transport price (fuel costs, boil-off costs, port fees, other costs…).

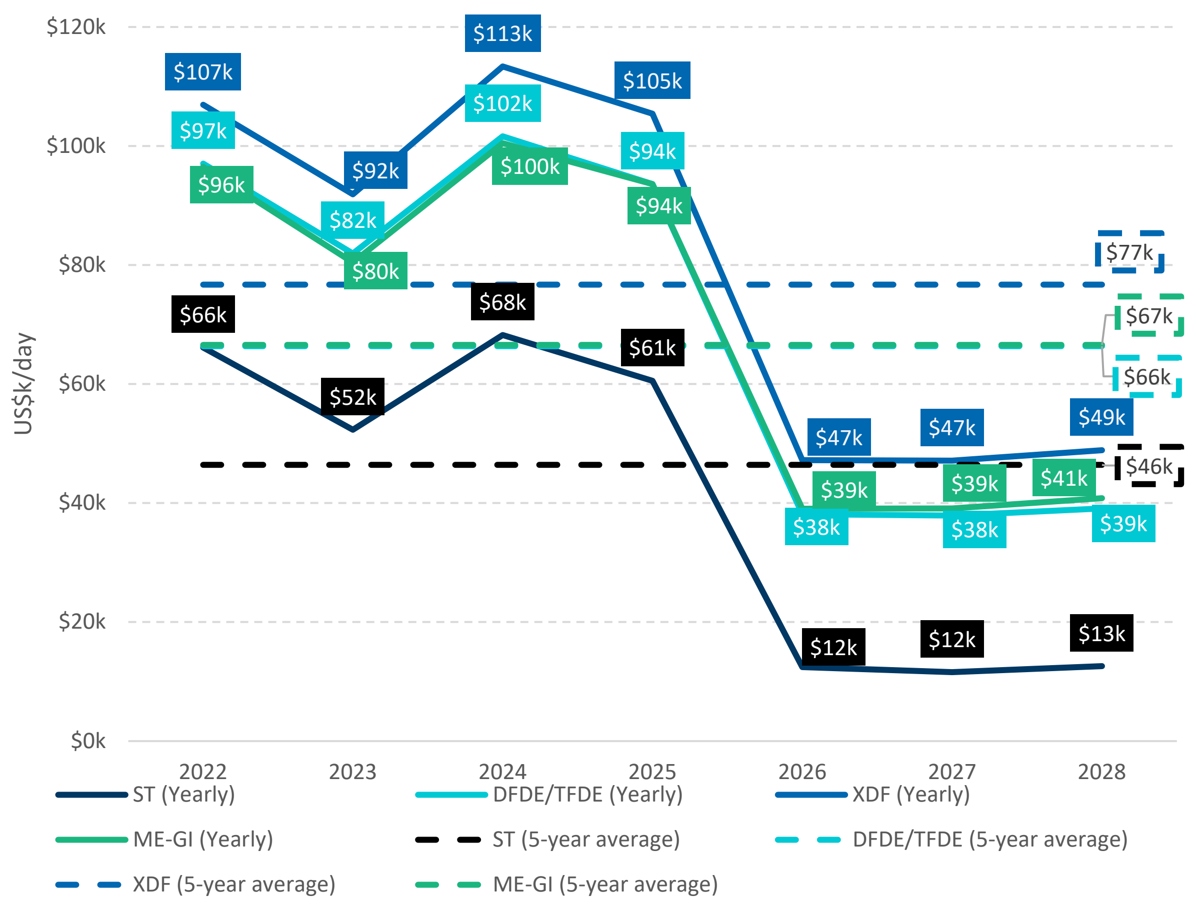
FTI gathers data from publicly available sources on LNG shipping, including LNG trade reports, LNG trades forecasts and LNG shipping reports, to support its modelling and estimates of LNG shipping freight rates. In addition, we have partnered with shipbroker Howe Robinson Partners (HRP) to provide comprehensive, up-to-date information on the global LNG shipping industry. HRP offers a full range of shipbroking services including newbuilding contracts, sale and purchase, demolition, and chartering, as well as market research and valuations. HRP data will be sent every six months to FTI Consulting to keep the model up to date with the latest developments in the LNG shipping market.

By convention, all model outputs will be expressed in real terms in the year in which we provide the results.

7. The modelled estimates of the annual LNG freight rates are presented in Figure 1 below, along with a medium-term average: the model's outputs are annual freight rates, and a five-year average over the period 2023-2028 was calculated as representative of medium-term freight rates.

8. The five-year estimates differ by technology, ranging between 46 US$k/day for the ST, i.e. the oldest technology with smallest carrier capacities, to 77 US$k/day for the XDF, i.e. the most representative newest and propulsion technology, with larger carrier capacities.

Figure 1: Average freight rates by propulsion technologies by year and 5-year average for the period 2023-2028, in real 2022 US$k/day



Sources: FTI analysis

Note: 2023 & 2028 are weighted as half-years in the 5-year average 2023-2028; 2022 not included in the average

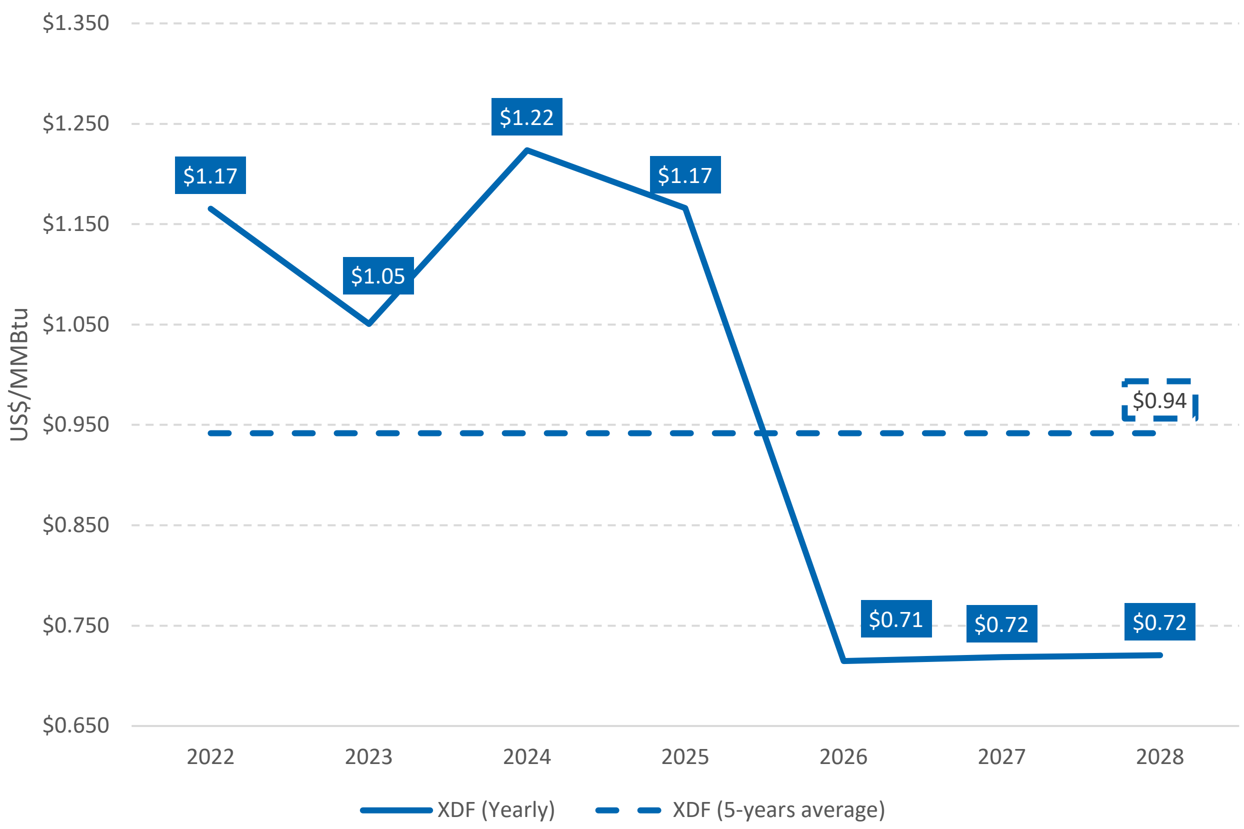
9. As we anticipate significant investment in new carriers in 2025, representing a 15% increase in the number of carriers in the available fleet, supply, i.e., vessel capacity, will exceed demand for LNG freight. Charter rates for all technologies are declining as a result of these investments. Vessels with the most efficient technologies will be selected first and charter rates for the least efficient technology, ST propulsion, are dropping to 12 US$k/day per day to encourage clients to charter this type of vessel (Figure 1). This result illustrates an excess of supply over demand.

10. The yearly estimates and the five-year average for the LNG shipping price for a round trip from Gladstone to Tokyo are presented in the following Figure 2. The results presented correspond to the XDF propulsion technology, which is dominating newbuilds and is expected to be the most common technology on the water from 2025 onwards [3]. However, as our model assumes a global

[3] XDF technologies represent 2/3 of the order books until 2028, according to HRP data. See Figure 11 infra for overview of forecasted LNG carrier vessels fleet.

price equilibrium of freight rates (in US$/ton.mile) across propulsion technologies, the Gladstone-Tokyo shipping prices of other technologies are similar (+/- 2%), to the ones presented for XDF below.

Figure 2: Average price of shipping Gladstone-Tokyo by year and 5-year average for an XDF propulsion technology, for the period 2023-2028, in real US$/MMBtu



Sources: FTI analysis
Note: 2023 & 2028 are weighted as half-years in the 2023-2028 average; 2022 not included in the average

11. The estimate of the five-year average shipping price from Gladstone to Tokyo for the period 2023-2028 is 0.94 US$/MMBtu.

12. The lower prices observed for 2023 and 2026-2028 are derived from the "loose mode" of the LNG Shipping model, where newbuild ships entering the market outstrip demand growth. In these years, there is accordingly a significant excess of supply over demand, and the least efficient vessels are not used to deliver LNG, driving lower freight rates which are based on marginal higher efficiency ships. The lower freight rates modelled for 2026-2028 are in line with past "loose" years in 2015-2017.

1.3. Structure of the report

13. This report is structured as follows:

Section 1 is the present section, which summarises the context, content and the structure of the report;

Section 2 presents the calculation of the demand side of the model, i.e., the annual global shipping demand in ton.mile;

Section 3 presents the calculation of the supply side of the model, i.e., the annual global shipping supply evolution including all the LNG carrier vessels' investments and disinvestments;

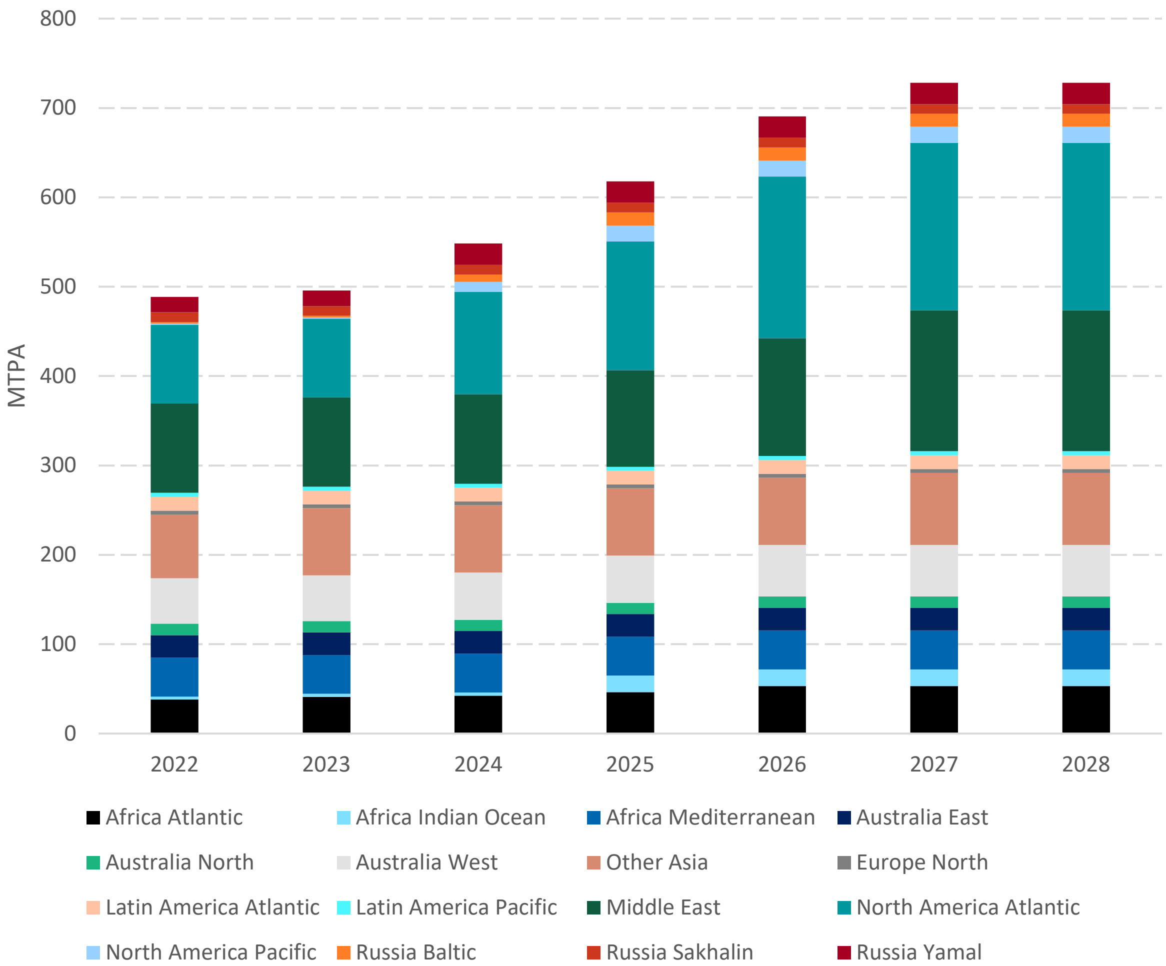
Section 4 presents the results of the equilibrium between supply and demand, i.e., the global shipping price and the annual freight rates per propulsion technology at equilibrium; and

Section 5 presents a comparison of the modelled results with alternative estimates from other sources.

2. Calculation of shipping demand

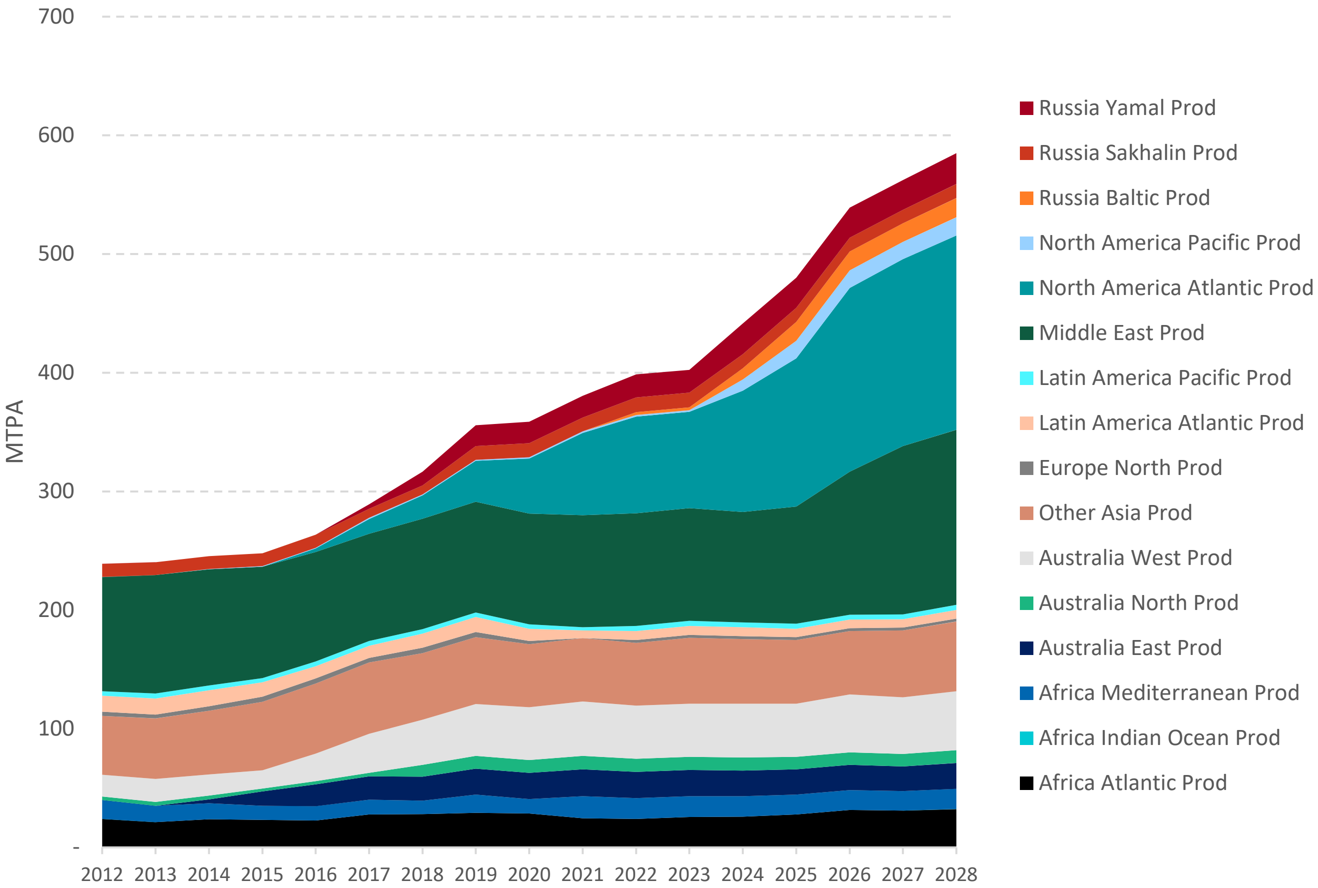
14. As explained in Section 4 of the FTI methodology report dated 9th August 2022, to quantify LNG shipping demand, we construct a forecast of the global LNG molecule trade based on the evolution of planned new liquefaction infrastructures (Figure 3), and from that determine the volume of imports and exports per region, augmenting historical imports and exports in proportion to the new infrastructure's capacities to be commissioned (Figure 4 and Figure 5). Since our previous report in August 2022, our liquefaction capacities forecast for 2027 (Figure 3) increased from 717 to 728 Million Ton Per Annum (+11 MTPA) based on new projects announced in recent months. Mechanically, if LNG liquefaction terminals capacity increases, imports and exports also increase according to our methodology (as presented Figures 4 and 5).

Figure 3: LNG liquefaction terminals capacity for the period 2022-2028, in MTPA



Sources: ICIS, FTI analysis

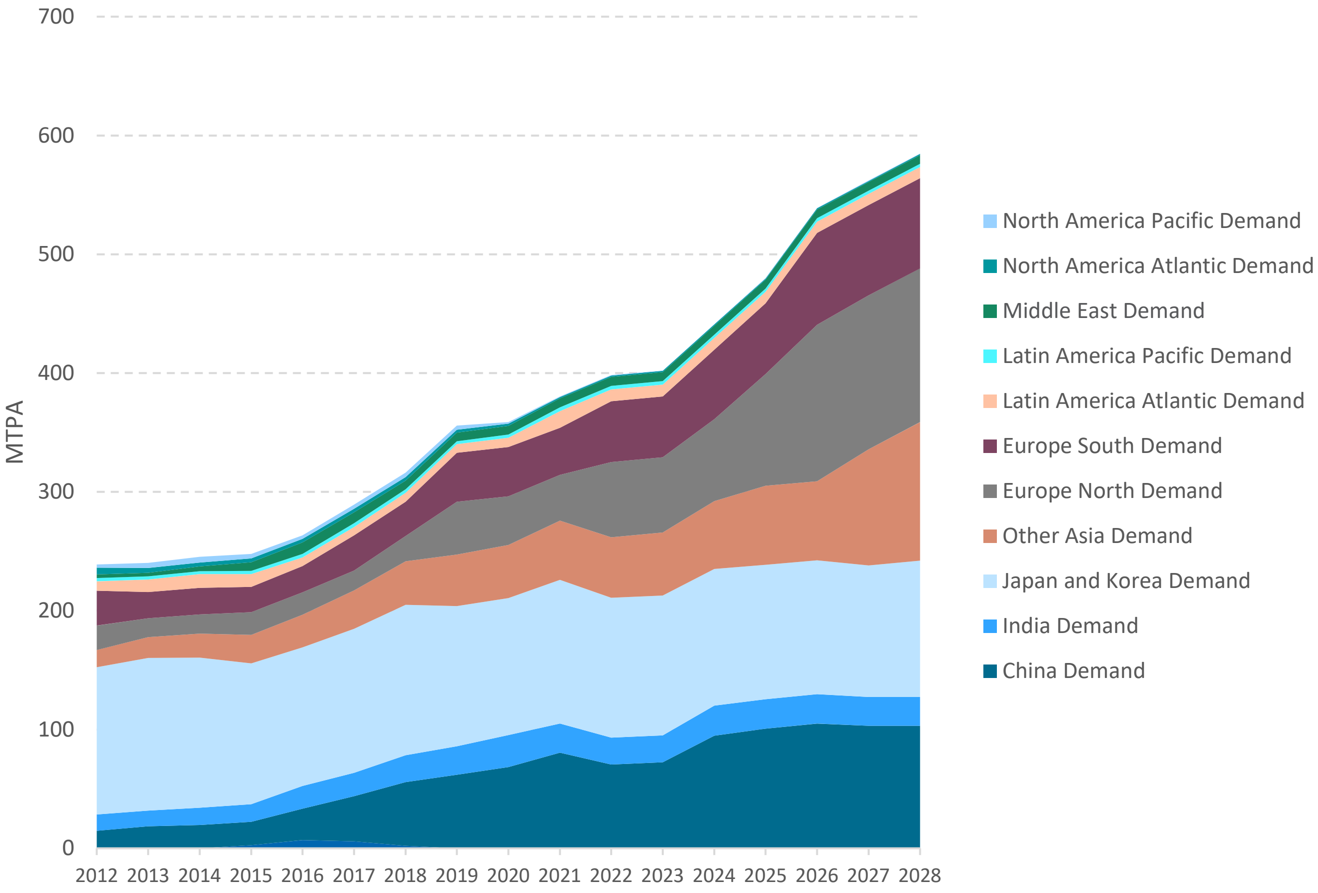
Figure 4: LNG exports scenario for the period 2012-2028, in MTPA



Sources: BP, ICIS, FTI analysis

Note: Refer to Methodology Report §30-32 for details

Figure 5: LNG imports scenario for the period 2012-2028, in MTPA



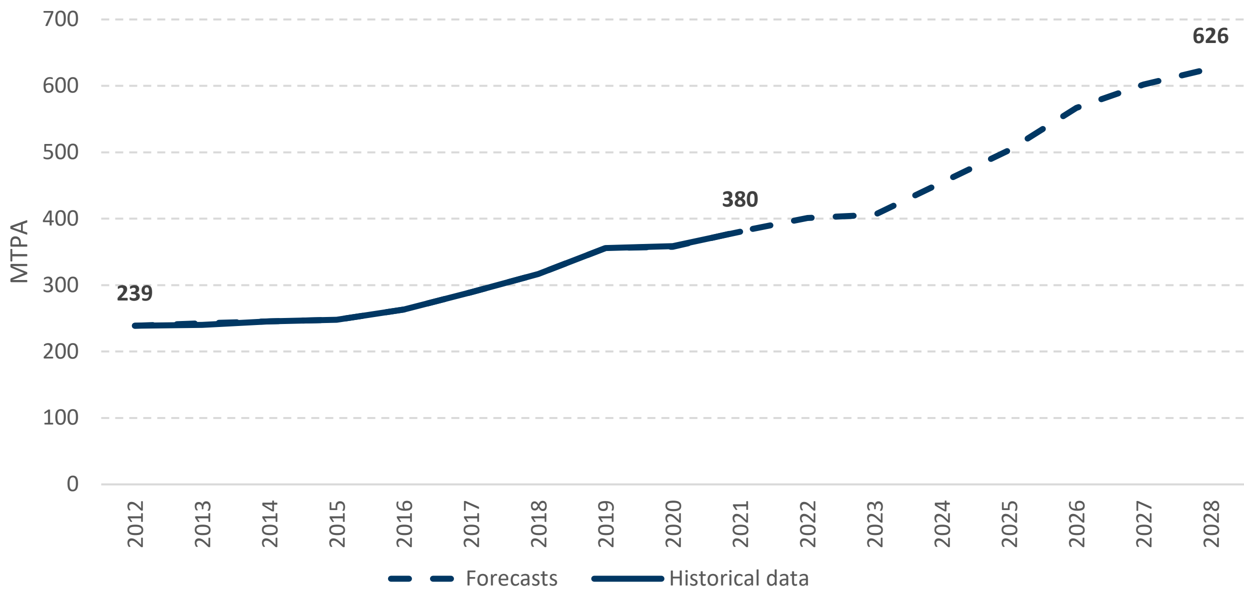
Sources: BP, ICIS, FTI analysis

Note: Refer to Methodology Report §30-32 for details

15. The global LNG demand forecast is then the sum of the projected imports for each of the 20 zones presented above[4]. LNG demand is expected to grow from 239 MTPA in 2012 to 626 MTPA in 2028. Since our previous report in August 2022, the 2027 LNG demand forecast increased from 562 to 602 MTPA.

[4] The model does not yet take into account a possible disruption of Russian LNG capacity. Regarding the evolution of the geopolitical scenarios observed at the time of the calculation of the results, some sensitivities will be added in the next results reports.

Figure 6: Global LNG demand for the period 2012-2028, in MTPA



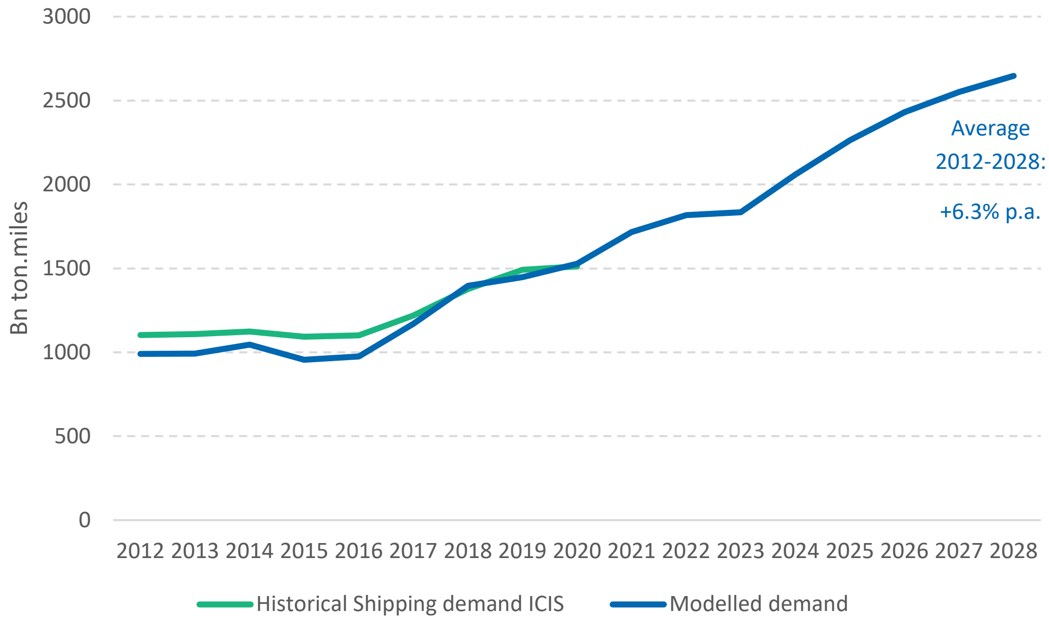
Sources: Historical data: bp, Forecasts: ICIS, FTI analysis

16. Then, using a dispatch optimisation model, we compute the LNG shipping demand, in ton.mile, by minimizing the total global LNG shipping costs to transport LNG from production areas to consumption areas, relying on an estimate of the cost of each LNG route[5]. In this optimization, we take into account forced routes stemming from fixed-destination LNG trade set by long-term contracts, which are assumed as fixed and thus not being optimizable.

17. Thus, FTI Consulting's shipping demand model determines the optimal global LNG flows between export and import zones (considering obligations of long-term contracts) and establishes the annual shipping demand in billion ton.miles, as showed in the Figure 7.

[5] The total cost of shipping on each route is based on the cost of transporting LNG using an average LNG carrier with standard capacity.

Figure 7: Shipping demand modelled for the period 2012-2028, in billion ton.miles



Sources: FTI analysis

18. Our modelled shipping demand follows the same trends as the actual shipping demand calculated based on the historical ICIS LNG carrier voyages database, confirming relevance of our LNG shipping demand estimation.

19. As shown in Figure 7, the shipping demand increases on average by 6.3% per year between 2012 and 2028, reaching 2,647 billion ton.miles in 2028. The evolution of the shipping demand follows the accelerated LNG molecule demand growth trends over the same period: global LNG liquefaction capacity increases from an average annual growth of 4.9% between 2012 and 2021 to an average annual growth of 6.9% between 2022 and 2028.

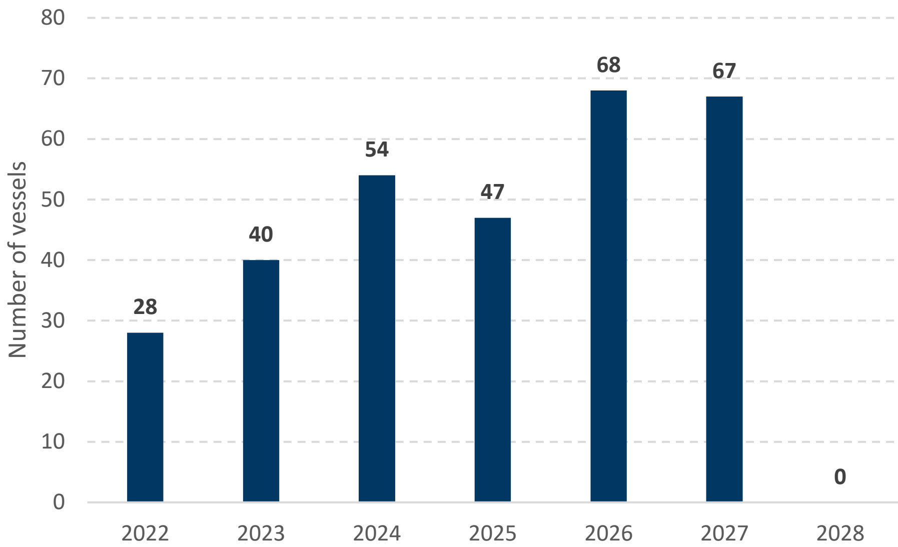
3. Calculation of shipping supply

20. On top of the operational LNG carrier vessels fleet and the LNG carrier vessel orders registered by the shipyards, our model endogenously balances supply and demand for shipping by investing in new ships (modelled investment) and removing old and uncompetitive ships (modelled disinvestment).

3.1. Known fleet and modelled investment

21. First, we rely on the existing operational fleet and firm orders in order book. Comparing to our previous report, 39 new LNG carrier vessels have been added in order book for 2026 and 2027, (no order yet registered for 2028).

Figure 8: Orderbook for LNG carrier vessels for the period 2022-2028

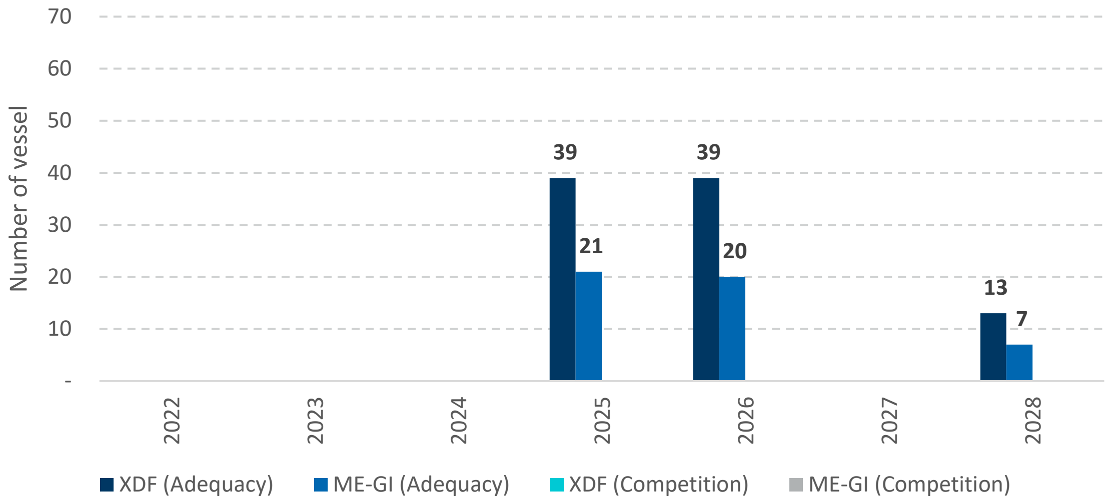


Sources: ICIS order books, FTI analysis

22. Second, we model two types of new ship investments, that add to the operational and ordered LNG carrier vessels: (1) adequacy investment, and (2) competition investment.

23. The results of the expected investments to be made between 2022 and 2028 are presented in Figure 9 below. New vessels joining the fleet based on the modelled investments have the average properties of the vessels expected to be commissioned between 2022 and 2028, based on order book.

Figure 9: Investments in new LNG carrier vessels for the period 2022-2028



Sources: FTI analysis

24. In Figure 9 above, the modelled investments in new ships correspond to adequacy investments only. These investments are necessary to meet the growing demand for LNG shipping from 2025 onwards. From 2022-2024, there is no additional competition investment, which means that the Long-Run Marginal Cost (LRMC) of new investments in ME-GI and/or XDF technologies remain above the Short-Run Marginal Cost (SRMC) of the operating LNG carrier vessels. In 2025 and 2026, the estimated shipyards' capacity limit is reached for adequacy purposes, which leaves no possibility for competitive investments. Finally, in 2028, there is a second smaller wave of adequacy investments to mitigate the scrapping of older vessels due to disinvestment (as presented below).

3.2. Modelled disinvestment

25. As explained in the methodology report (Paragraph 53) from August 2022, we model two different mechanisms for LNG carrier vessels to exit the market: (1) age exit, and (2) economic exit[6]. The exit of vessels is capped at 20% of the existing fleet to reflect a degree of inertia in shipowners' disinvestment decisions, as suggested by LNG shipbroker HRP.

26. The results of the model for disinvestment are illustrated in the Figure 10 below.

[6] Vessels converted to FSRUs are also removed from the existing fleet, based on the FSRUs in the most recent GIIGNL report.

Figure 10: Exit of LNG carrier vessels for the period 2022-2028

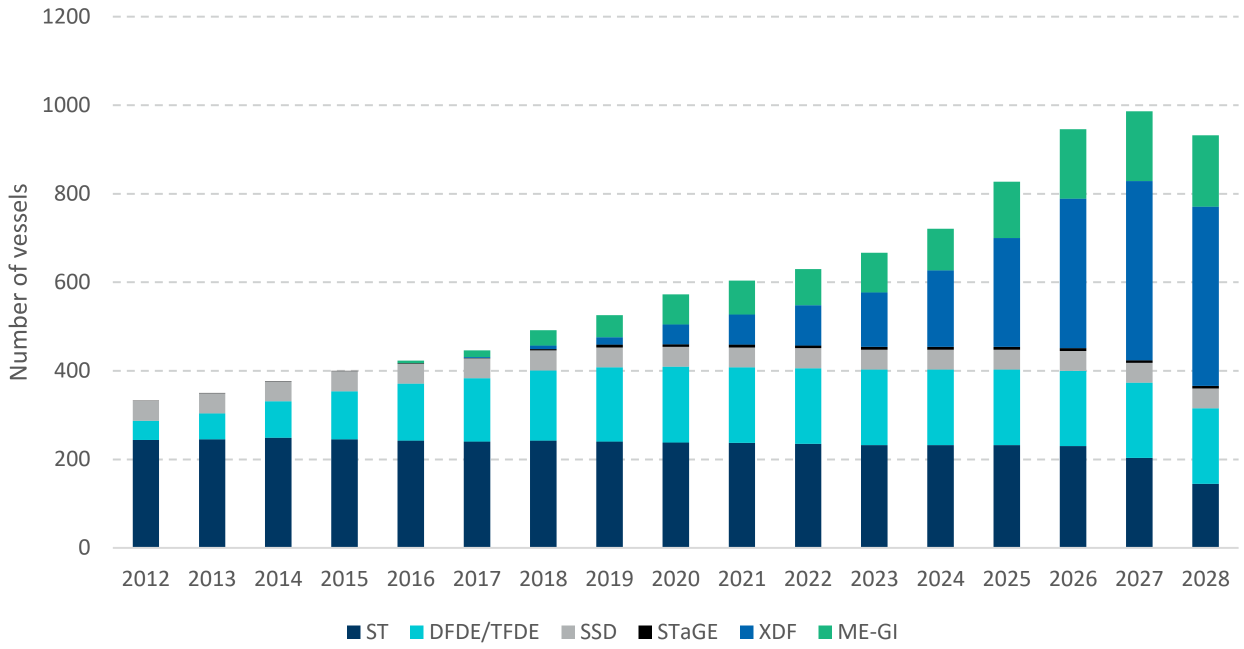
Sources: FTI analysis

27. The results show significant divestments in 2027 and 2028 with respectively 27 and 57 ship exits, for economic reasons, which corresponds to the replacement of ST-powered vessels mainly by XDF-powered vessels. Over the years 2025-2027, a significant wave of new vessels entries materializes which lead to exits of ST-powered vessels. However, comparing to our previous report, this exit wave is happening later (2028 rather than 2027) due to higher shipping demand maintaining older ships in service longer.

3.3. Global fleet of LNG ships

28. The sum of the actual LNG carrier vessels fleet from 2012 to 2022, the confirmed orderbook until 2028 and the modelled investments and divestments, results in a fleet of 985 ships in 2027, which represents an increase of 78 units compared to our previous report, and 947 vessels for 2028 with the exit of ST-powered vessels. The total supply capacity of the fleet amounts to 2,742 billion ton.miles by the end of 2028. Despite the exit of some ST-powered vessels, the LNG shipping supply remains above the LNG shipping demand which reaches 2,646 billion of ton.miles in 2028.

Figure 11: Global LNG fleet by technology for the period 2022-2028



Sources: 2012-2021: ICIS and GIIGNL, 2022-2028: ICIS and FTI analysis

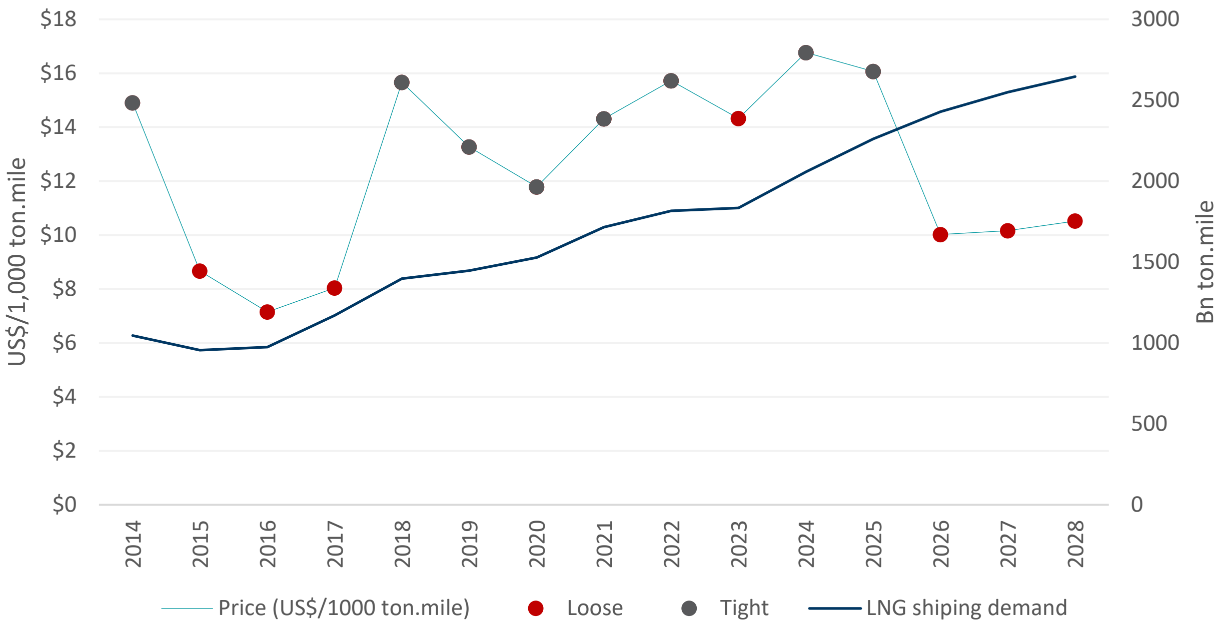
4. Determination of the price equilibrium and freight rates

4.1. Results of the model

29. The model assesses the equilibrium between LNG shipping supply and demand, on an annual basis. The result of the model is the equilibrium shipping price (US$/ton.miles), which allows to calculate the average freight rate (US$/day) for each type of propulsion technology.

30. We present in Figure 12 below the results of the equilibrium shipping price.

Figure 12: LNG shipping demand, in Bn ton.mile, and shipping price, for the period 2014-2028, in real 2022 US$/1,000 ton.mile



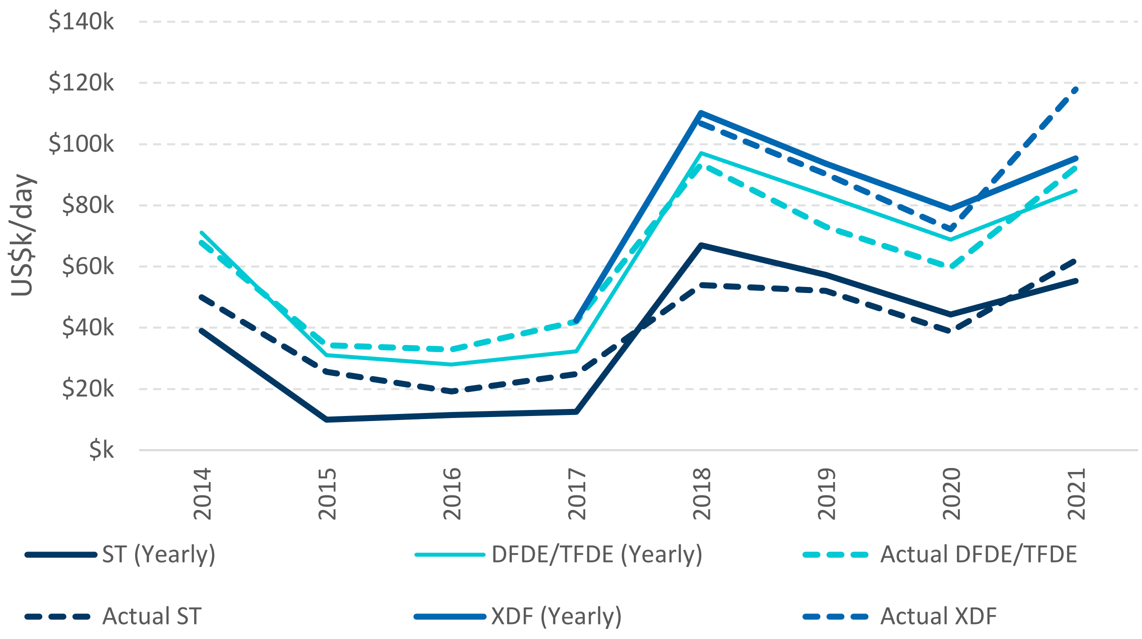
Sources: IMF (for inflation), FTI analysis

31. The equilibrium price varies between periods of tension between supply and demand, i.e., tight periods, when the price of shipping is higher, and periods of slack, when the price of shipping decreases due to a higher supply/demand ratio. FTI Consulting models different equilibria between supply and demand over the years, which drive the prices variation. Years 2022, 2024, 2025 are "tight" in the sense that the reserve margin between total supply capacity and total demand is lower than the historical average reserve margin, which is expected to lead to some scarcity pricing. The switch between tight and loose market tension drives important variations in annual equilibrium price over 2022-2028.

4.2. Back cast of the model

32. In Figure 13 below, we present the results of the modelled freight rates as well as actual data for the historical period between 2014 and 2021.

Figure 13: Modelled freight rates vs. historical actual freight rate for the period 2014-2021, in real 2022 US$k/day



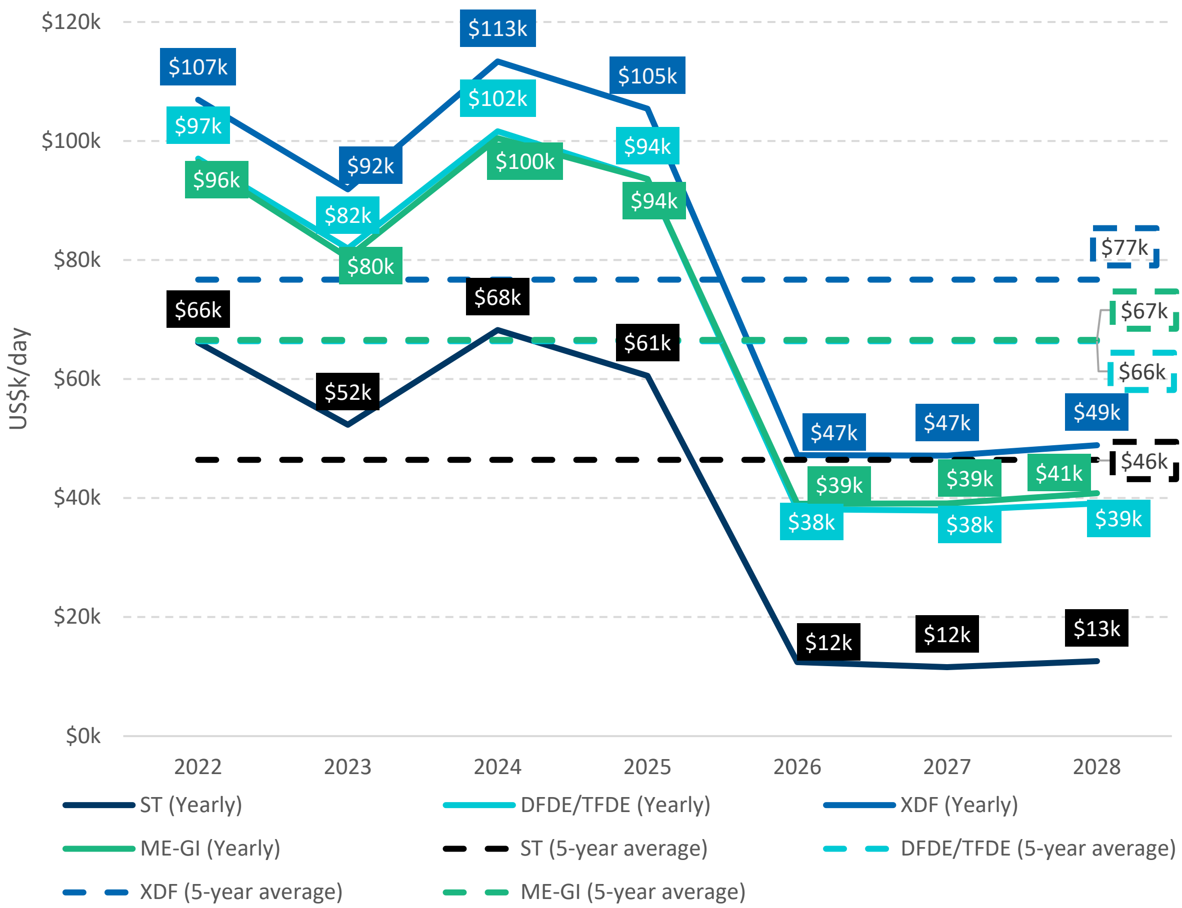
Sources: Actual data: HRP, Modelled data: FTI analysis

33. The model appears to correctly replicate historical freight rates seen for the three main technologies, ST, DFDE/TFDE and XDF vessels, over the historical period 2014-2021.

4.3. Forecasts from the model

34. Looking forward, the model provides annual freight rates by propulsion engine technology for the period 2022-2028, as well as a five-year average of these freight rates by technology, that represent a medium-term average freight rate based on opportunity cost.

Figure 14: Average freight rates by propulsion technologies by year and 5-year average for the period 2023-2028, in real 2022 US$k/day



Sources: FTI analysis

Note: 2023 & 2028 are weighted as half-years in the 5-year 2023-2028 average; 2022 not included in the average

35. The trend in annual freight rates shows a significant decrease in 2023, due to a decrease in the price of shipping as a result of the increase in supply from investments in ships while shipping demand remains relatively stable between 2022 and 2023. In 2024, the demand for shipping increases by 17%, which has a direct positive impact on freight rates. In the following years, freight rates decrease due to numerous investments in new ships, confirmed from order books, and additional endogenous investments from the model optimisation.

36. FTI Consulting models different equilibria between supply and demand over the years, which drive the prices variation. Years 2022, 2024, 2025 are "tight" in the sense that the reserve margin between total supply capacity and total demand is lower than the historical average reserve margin, which is expected to lead to some scarcity pricing (cf. paragraph 53 of the methodology

report)[7]. Conversely, years 2023, 2026 and 2027 are relatively “loose” where newbuild ships entering the market outstrip demand growth. In these relatively “loose” years, there is accordingly a significant excess of supply over demand, and the least efficient vessels are not used to deliver LNG, driving lower freight rates which are based on marginal higher efficiency ships. The lower freight rates modelled for 2023, 2026 and 2027 are in line with past relatively “loose” years in 2015-2017.

37. The price of the LNG shipping voyage from Gladstone, Australia to Tokyo, Japan is calculated using the shipping price (US$/MMBtu) for the Gladstone-Tokyo route distance. Below is our calculation, relying on the dominant new propulsion technology, XDF, for the price of shipping from Gladstone to Tokyo in US$ per MMBtu, for the years 2022 to 2028.

38. In general, the freight rate estimates are higher than those in FTI Consulting’s first report from August 2022. This is primarily due to the upward revision of estimated future LNG demand, and changes in macroeconomic factors, such as the inflation rate and future gas and oil prices.

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[7] In the "tight" mode, the reserve margin is below the threshold determined by historical data, resulting in prices that follow a regression of historical data, while in the relatively "loose" mode, the model's reserve margin is above the threshold and prices are set as the SRMC of the least efficient technology required to meet demand.

Table 1: Calculation of the shipping price from Gladstone to Tokyo and back for the XDF propulsion technology for the period 2022-2028, in real terms (2022 US$)

	Source	Unit	2022	2023	2024	2025	2026	2027	2028
FTI model Freight rates		Real US$	**2,183,223**	**2,144,149**	**2,022,947**	**2,015,296**	**1,989,810**	**1,972,715**	**1,960,179**
FTI model Daily freight rates	FTI Outputs	Real US$/day	106,925	91,863	113,371	105,424	47,229	47,131	46,793
Number of days for the round trip Gladstone-Tokyo(1)	ICIS, FTI analysis	day	27.35	27.35	27.35	27.35	27.35	27.35	27.35
Fuel		Real US$	**109,333**	**100,799**	**97,236**	**93,673**	**90,110**	**86,547**	**82,950**
HFO price	IEA "Announced Pledges" scenario	US$/ton	767	698	670	642	614	585	557
MDO price	IEA "Announced Pledges" scenario	US$/ton	653	648	643	637	632	627	621
HFO consumption	Maran Gas Maritime	ton/day	5	5	5	5	5	5	5
MDO consumption	Maran Gas Maritime	ton/day	1	1	1	1	1	1	1
Number of days at sea for the round trip Gladstone-Tokyo(2)	ICIS, FTI analysis	day	24.35	24.35	24.35	24.35	24.35	24.35	24.35
Boil off		Real US$	**752,683**	**772,445**	**792,207**	**811,969**	**831,731**	**851,493**	**871,255**
LNG consumption	HRP	ton/day	108	108	108	108	108	108	108
Number of days for the round trip Gladstone-Tokyo(1)	ICIS, FTI analysis	day	27.35	27.35	27.35	27.35	27.35	27.35	27.35
Gas price	IEA "Announced Pledges" scenario	US$/ton	255	261	268	275	282	288	295
Port fees		Real US$	**269,031**	**269,031**	**269,031**	**269,031**	**269,031**	**269,031**	**269,031**
Load fee	HRP	US$	200,119	200,119	200,119	200,119	200,119	200,119	200,119
Discharge fee	HRP	US$	68,912	68,912	68,912	68,912	68,912	68,912	68,912
Other fees		Real US$	**12,354**	**12,354**	**12,354**	**12,354**	**12,354**	**12,354**	**12,354**
Inspection fee for loading	Market players' interviews	US$	6,177	6,177	6,177	6,177	6,177	6,177	6,177
Inspection fee for discharge	Market players' interviews	US$	6,177	6,177	6,177	6,177	6,177	6,177	6,177
Total price of the voyage		Real US$	**4,067,948**	**3,667,204**	**4,271,677**	**4,070,520**	**2,495,005**	**2,508,522**	**2,515,440**
Average ship capacity		MMBtu	**3,491,021**	**3,491,021**	**3,491,021**	**3,491,021**	**3,491,021**	**3,491,021**	**3,491,021**
Total price of the voyage		US$/MMBtu	**1.165**	**1.050**	**1.224**	**1.166**	**0.715**	**0.719**	**0.721**

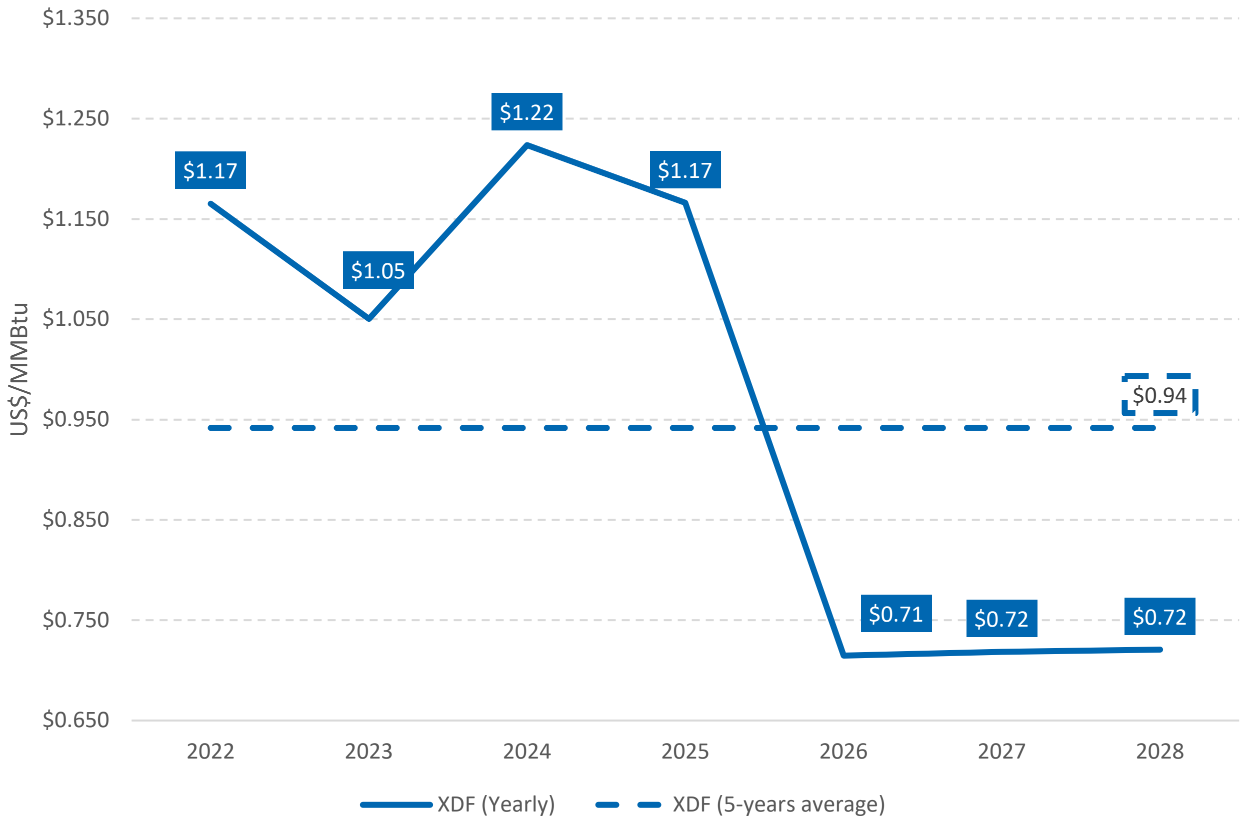
Sources: ICIS, HRP, FTI analysis, IEA WEO 2022

Notes: The total cost of the trip is expressed in real terms using IMF inflation estimates until 2025; for 2026–2028, the inflation rate is calculated as the average of the inflation rates from 2020–2025.

(1) The number of days for the round trip is calculated with a distance of 3,750 nm, a speed calculated as the average speed of all trips in the ICIS database above 851 nm, i.e., the shortest distance between two zones determined by FTI, for the period 2018-2021, and 3 additional days in ports.

(2) Same as above but without the 3 additional days in ports.

Figure 15 - Average price of shipping Gladstone-Tokyo by year and 5-year average for an XDF propulsion technology, for the period 2022-2028, in real US$/MMBtu



Sources: FTI analysis

Note: 2023 & 2028 are weighted as half-years in the average; 2022 not included

39. The results presented show the shipping price for the XDF technology, the dominant current propulsion technology. Given the general price equilibrium assumed in the LNG shipping market, all technologies should offer the same price of transport (in US$ per ton.mile) on average globally. Accordingly, the shipping prices from Gladstone to Tokyo for the other technologies modelled (ST, DFDE/TFDE, ME-GI) are within a range of +/- 2% of the above XDF results.

5. Discussion of results - Cross-checks

40. The results obtained from the model are compared with alternative estimates from other sources, either (1) from future freight rate fixtures and forecasts, or (2) derived from current CAPEX of newbuild LNG carrier vessels.

5.1. Freight rates cross-checks

41. We compare the model's forecast of freight rates with two independent sources of medium-term freight rates estimates:

- **HRP data:** Average Medium-term charter fixtures, observed in the past 12 months;
- **ICIS data:** Long-term freight rate, as estimated by ICIS; and

42. The comparison is done with the freight rates of the most representative propulsion technology of the orderbook which is expected to be the most representative of the operational fleet in the medium-term: the XDF propulsion technology.

43. Data provided by HRP include 22 fixtures contracted between 2021 and 2022, which last each in between 4 months and 10 years in the future.

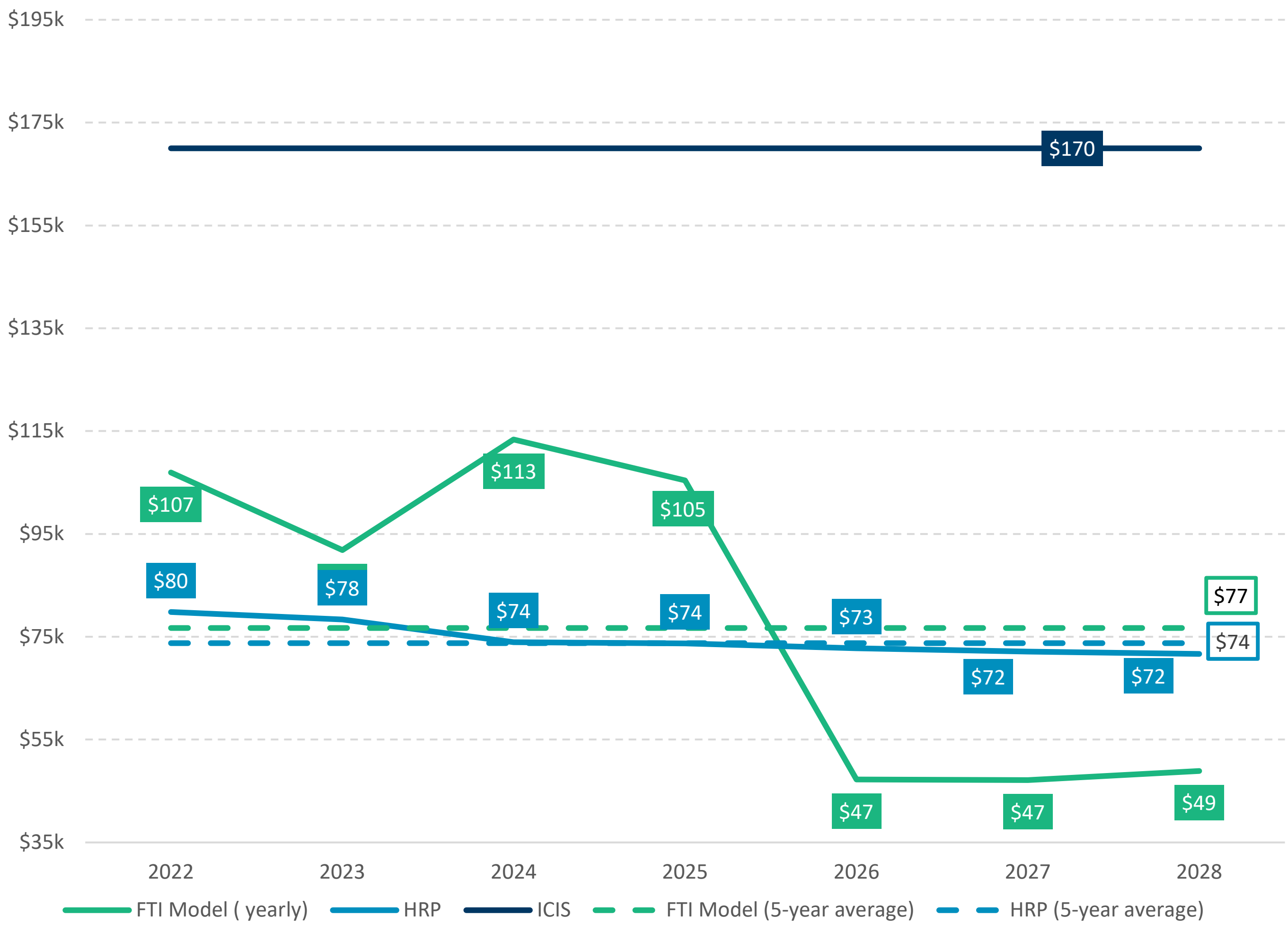
Table 2: Number of fixtures for the XDF propulsion engine observed in the past 12 months

Start year of fixture	2022	2023	2024	2025	2026	2027	2028
Number of fixtures for XDF technology	14	14	13	11	10	8	6

Sources: HRP, FTI analysis

44. We present below the annual average of the HRP fixtures, as well as the ICIS long-term freight rate estimate.

Figure 16: Model results and cross-checks for freight rates of XDF propulsion vessels for the period 2022-2028, in real 2022 US$k/day



Sources: ICIS, HRP, FTI analysis

Note: 2023 & 2028 are weighted as half-years in the average; 2022 not included in the average

45. The model average results at 77 US$k/day are in-between HRP average of fixtures (74 US$k/day) and ICIS long-term estimate of 170 US$k/day, but much closer to HRP average of fixtures.

46. We note that the model results are more volatile than the cross-checks data, as the model is an annual optimisation assuming perfect information of the different stakeholders, which may differ from a limited sample of fixtures based on expectations of some market players for various future periods, as HRP collects and ICIS estimates. We however note that strong annual price variations are in line with historical price behaviours on the LNG shipping market (cf. Figure 13).

47. The long-term LNG freight rate estimate from ICIS is based on a single value, leading to a flat forecast, representing "fixtures for a chartering period of between one and seven years, with delivery to start within two years of the transaction date"[8]. As such, it represents a variety of periods which all start at a delay from current year, which is different from the 5-year near-term horizon we compute. By including this delay, ICIS may also overweight fixtures based on newbuild LNG carrier vessels that are typically set several years in advance. The actual price information used by ICIS to produce its long-term freight rate estimate is not disclosed by ICIS. We note that the ICIS long-term freight rate estimate available in December 2022 is nearly three times as high as the ICIS estimate we presented in August 2022.

48. The average of HRP fixtures is computed by averaging all available HRP's freight price data (for duration of 4 months to 10 years), which may not be representative of the trades that will take place in future annual markets. This sample however represents actual transaction data. We note that the average of HRP fixtures decreased by 1% between our computations in August 2022 and in December 2022.

49. We note a significant difference between the ICIS estimate and the average of HRP fixtures, with the former being x2.3 times the latter. This suggests an absence of consensus on the medium-term LNG freight rate from market observers, amidst important spot freight rates movements in H2 2022[9], which may limit the relevance of cross-checks in the present report.

5.2. Gladstone-Tokyo route cross-checks

50. A comparison of the price of LNG transport from Gladstone, Australia, to Tokyo, Japan obtained with the model is made with HRP data (which we find may be a more relevant cross-check than ICIS, as it is based on actual transaction prices communicated to us).

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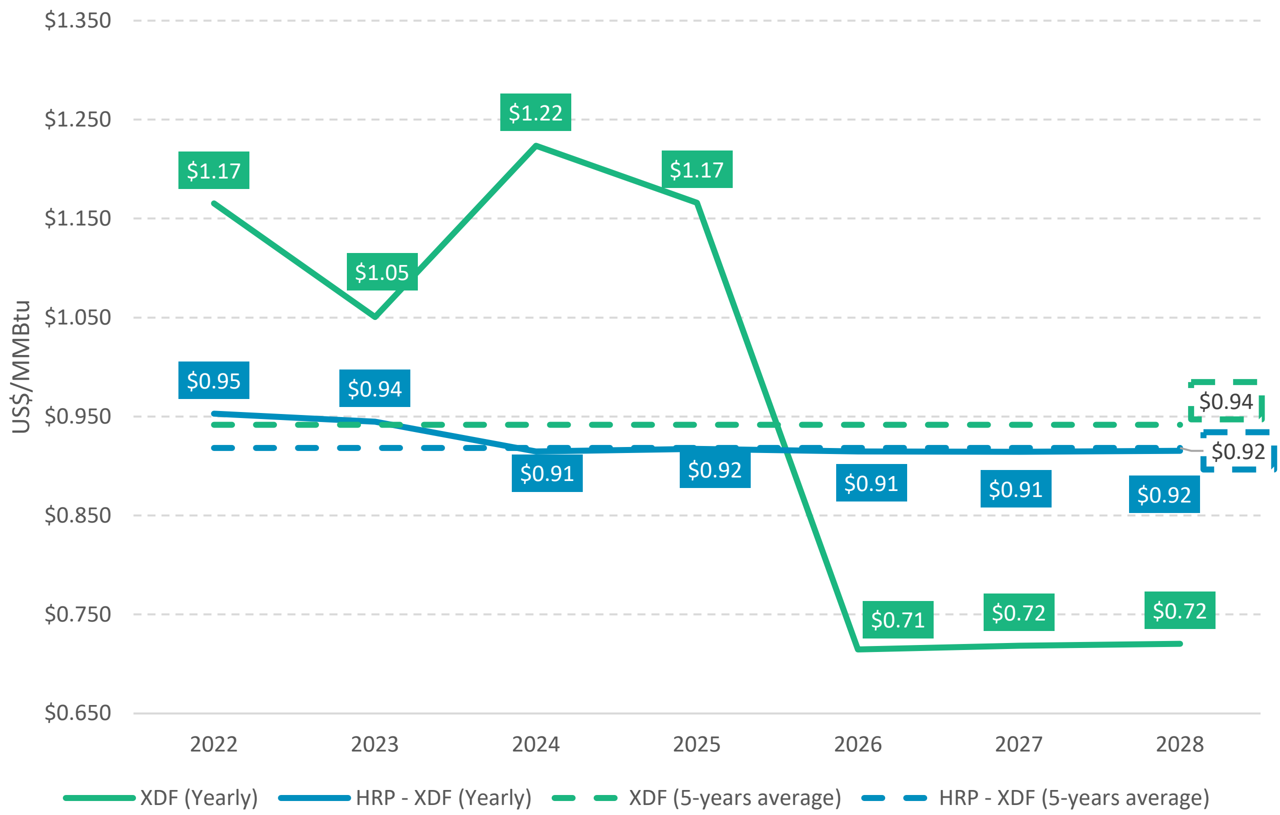
[8] ICIS, Global LNG Markets Methodology, 23 June 2021, p.19: https://cjp-rbi-icis-compliance.s3.eu-west-1.amazonaws.com/wp-content/uploads/2021/06/23112517/Global-LNG-Markets-Methodology-23-June-2021.pdf

[9] According to ICIS, spot LNG freight rates were multiplied by x5 between June and November 2022.

Figure 17: Model prevision results and cross-checks for price of LNG transport Gladstone-Tokyo for the period 2022-2028, in real US$/MMBtu



Sources: ICIS, HRP, FTI analysis

51. The results show comparable prices for HRP data and the outputs from FTI model, with a modelled average price over five-year of LNG shipping at 0.94 US$/MMBtu and an HRP fixtures average estimate at 0.92 US$/MMBtu.

52. Here the shipping costs are derived from freight rates, and the trends in variation are therefore similar.

5.3. CAPEX cross-check

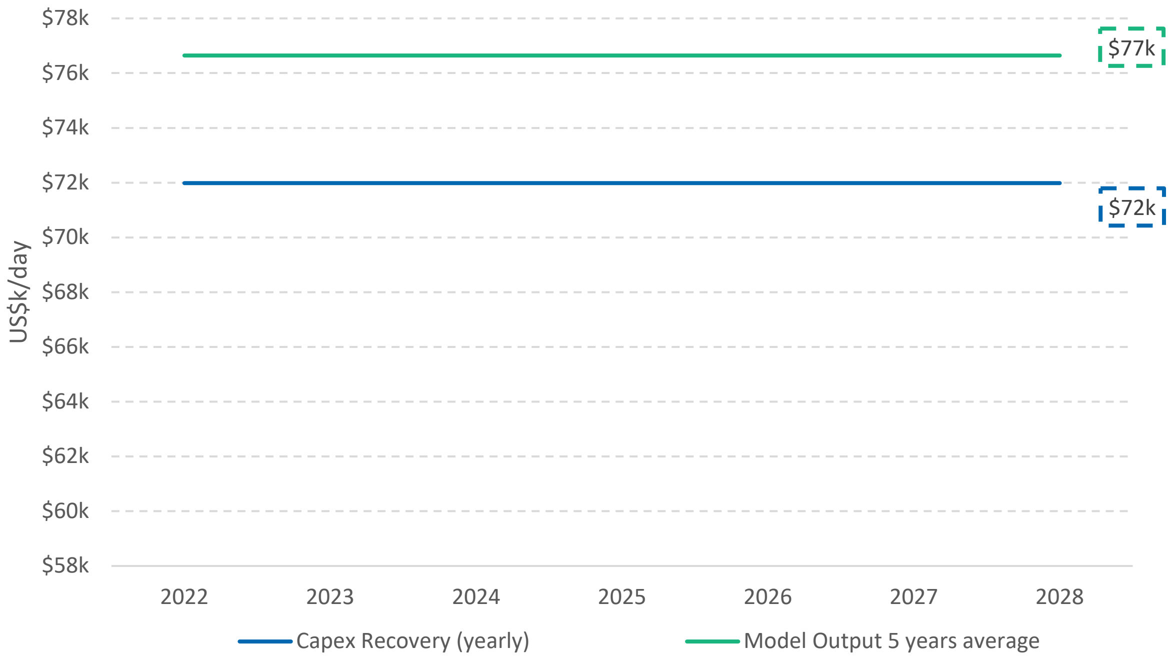
53. The CAPEX cross-check computes an indicative freight rate required to allow for the recovery of an investment in a new build LNG carrier at current CAPEX prices. Current LNG prices are estimated based on observed CAPEX for a newbuild XDF LNG carrier vessel contracted in the last 6 months, provided by HRP. Using an indicative estimate of industry Weighted Average Cost of Capital (WACC) and related time horizon[10], we define an annual CAPEX recovery payment, and add OPEX to determine the expected freight rate that can be expected for a newbuild. According to HRP, there are however significant variations in WACC at different periods of time and across

[10] Indicative industry Weighted Average Cost of Capital (WACC) of 5.9% (nominal) and investment horizon of 25 years, as provided by Hellenic Shipping News (link)

shipowners, as well as different time horizons for CAPEX recovery; accordingly, this CAPEX-based freight rate cross-check should be seen as indicative and not necessarily representing current average financing conditions, which would require specific further study to be determined robustly.

54. Indicatively, we thus find a yearly CAPEX recovery freight rate of 72k US$/day which is in line with FTI's model-based forecast of the XDF freight rates, which has a five-year average of 77k US$/day. These new figures, respectively increased by 18% and 24% from our previous report, are in line with the rising building cost of the shipyard with the latest newbuilt dual strokes orders exceeding USD 250 million (+27% as compared to our previous report)[11].

Figure 18: Model results, Capex Recovery yearly freight rate of newly built XDF vessels in the period 2022-2028, in real 2022 US$k/day



Sources: HRP, Hellenic Shipping News, FTI analysis
Note: ICIS long-term charter also represented as of a similar long-term nature as CAPEX recovery charter rate

[11] Source: HRP.