US liquefied natural gas attracting attention

Development and enhancement of competitive LNG procurement environment is important

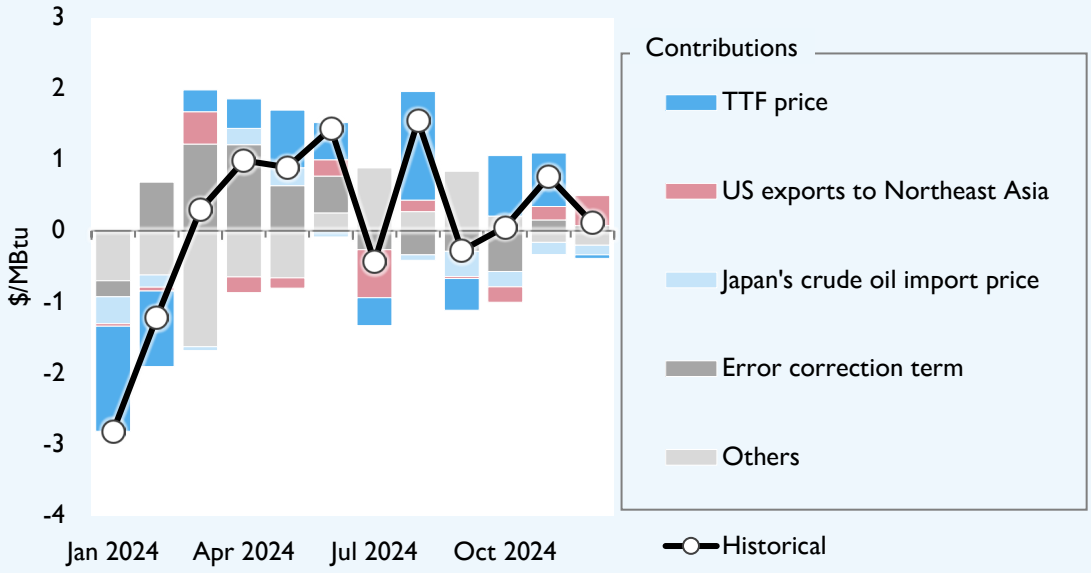
YANAGISAWA Akira
Executive Economist, The Energy Data and Modelling Center, The Institute of Energy Economics, Japan

Summary

The United States-Japan Joint Leaders' Statement for the bilateral summit meeting in February 2025 attracted attention by noting that 'the two leaders announced their intention to strengthen energy security … by increasing exports of U.S. liquefied natural gas to Japan'. US LNG has been discussed at such a high level not only for Japan.

While the US LNG trade, which characteristics are different from those of traditional LNG trade under long-term contracts, is increasing, Northeast Asian LNG spot prices have been increasingly co-moved to European natural gas prices due mainly to Europe's rapid expansion of LNG imports after Russia's invasion of Ukraine. When the Dutch Title Transfer Facility, the leading European benchmark for natural gas prices, changes by $1 per million British thermal units in a month, the Northeast Asian LNG spot price fluctuates by an average $0.75/MBtu in the same month. When US LNG exports to Northeast Asia increase by 1 billion cubic metres, the Northeast Asian LNG spot price falls by $0.56/MBtu.

Figure 1 | Breakdown of contributions to Northeast Asian LNG spot price fluctuations



The rise of US LNG has reportedly enhanced the co-movement between the Northeast Asian LNG spot and TTF prices, while falling short of strengthening the linkage between the Northeast Asian LNG spot price and the US benchmark Henry Hub natural gas price. The quantitative expansion of US LNG does not necessarily guarantee the Northeast Asian LNG spot price's convergence (decline) to the HH price.

Keywords: Liquefied natural gas (LNG), United States, Asia LNG spot, Title Transfer Facility (TTF), Henry Hub (HH)

If Northeast Asia aims to lower natural gas procurement costs through US LNG imports, the quantitative expansion alone may not be enough to achieve the aim. Unless a natural gas supply system is developed for Northeast Asia to procure natural gas at competitive prices from countries other than the United States, Northeast Asia may fail to fully benefit from the lower HH price.

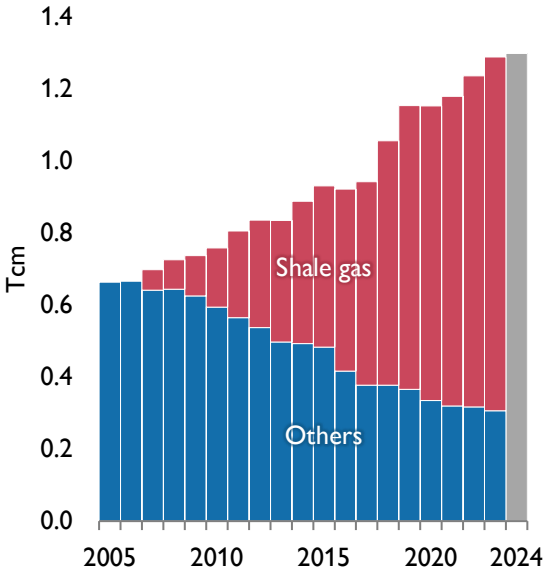
Interest growing in US liquefied natural gas over Trump tariff hikes

In February 2025, Japanese Prime Minister Shigeru Ishiba held his first meeting with US President Donald Trump. Regarding bilateral economic relations, their published joint statement called for increasing Japan's investment in the United States to $1 trillion, for promoting business opportunities and significantly increasing bilateral investment and employment, and for bilateral collaboration to lead the world in developing critical technologies, such as artificial intelligence (AI), quantum computing and leading-edge semiconductors[1]. As for the energy area, the statement attracted attention by noting that 'the two leaders announced their intention to strengthen energy security … by increasing exports of U.S. liquefied natural gas to Japan'.

US liquefied natural gas (LNG) has been discussed at such a high level not only for Japan. In November 2024, European Commission President Ursula von der Leyen cited the European Union's potential expansion of US LNG imports to prevent the United States, concerned about its trade deficit with the European Union, from launching a trade war with the union. At a joint press conference by Indian Prime Minister Narendra Modi and US President Trump after their meeting in February 2025, Mr Trump said that India could increase US LNG and crude oil imports to offset a US trade deficit with India.

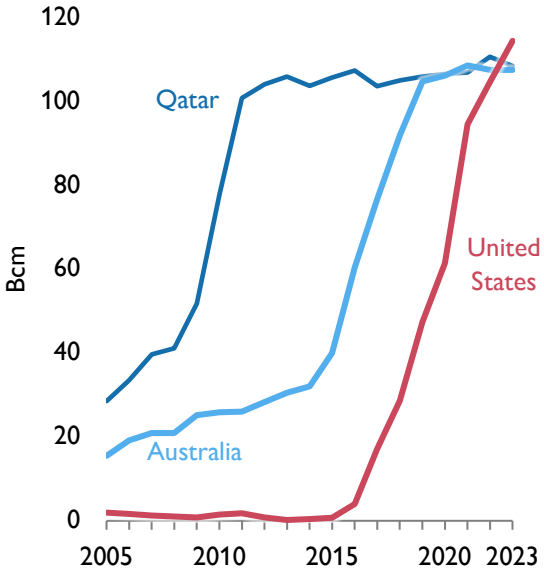
The US shale revolution has brought about such potential trade measures. The United States has explosively increased natural gas and crude oil production (Figure 2). After achieving self-sufficiency in natural gas, the United States launched LNG exports from its 48 mainland states in 2016 and became the world's largest LNG exporter in several years (Figure 3).

Figure 2 | US natural gas production



Note: The breakdown in 2024 remains unknown.
Source: U.S. Energy Information Administration

Figure 3 | LNG exports from major countries

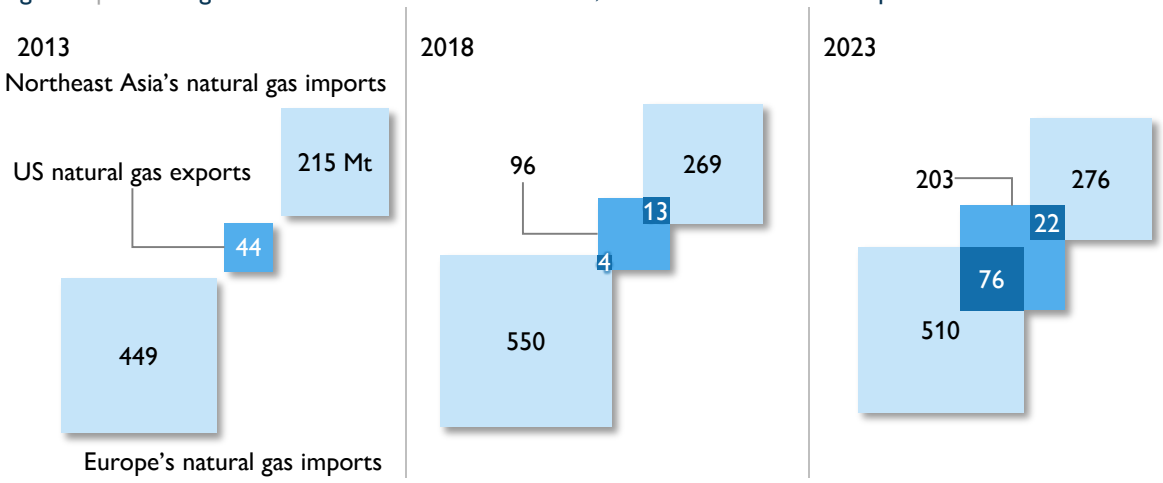


Source: Energy Institute "Statistical Review of World Energy"

[1] Ministry of Foreign Affairs 'United States-Japan Joint Leaders' Statement', https://www.mofa.go.jp/files/100791691.pdf.

The rise of US LNG has brought about major changes in Northeast Asia and, more recently, in Europe. Both regions, which had no interest in US LNG a decade ago, now import US LNG in the order of 10 million tonnes or 10 billion cubic metres (Figure 4). Russia's invasion of Ukraine in 2022 prompted Europe to reverse its policy and phase down its dependence on Russian energy. Nevertheless, Europe has avoided any critical natural gas shortage thanks to natural gas consumption savings (including those attributable to warmer winter weather) and substitute imports from the United States and other countries. However, Europe's desperate buying of US LNG amid LNG production equipment troubles affected Asian and other weaker economies in the midst of the Ukraine crisis.

Figure 4 | Natural gas trade between the United States, Northeast Asia and Europe



Notes: LNG and pipeline gas are covered. Northeast Asia covers China, Japan, Korea and Chinese Taipei. Data include regional trade.
Sources: bp "Statistical Review of World Energy" and Energy Institute "Statistical Review of World Energy"

Europe and Northeast Asia have become the United States' major natural gas export destinations. The two regions account for nearly 90% of US LNG exports. Such concentration is remarkable for the United States as an exporter rather than for Europe and Northeast Asia as importers.

US LNG export expansion has increased co-movement between Northeast Asian LNG spot and TTF prices

The expansion of US LNG export volume and US LNG's characteristic differences from traditional LNG under long-term contracts have caused major changes. Europe's rapid expansion of LNG imports has accelerated the trend and been coupled with other factors[2] to cause major changes in Northeast Asia, the world's largest LNG market, following those in Europe. The link between the Northeast Asian LNG spot market and the European natural gas market has been strengthened. Arbitrage trade has prospered through spot transactions, reselling, export destination changes and other measures, contributing to increasing the co-movement between the two regional markets that were respectively independent and based prices on local supply and demand conditions.

For example, the Northeast Asian LNG spot price and the Dutch Title Transfer Facility (TTF) price[3], known as the leading European benchmark natural gas price, have increased their co-movement. Until the first half of the 2010s, they had no strong relationship, with a low correlation coefficient[4] (the upper part of Figure 5). The ratios of a monthly changes in the Northeast Asian LNG spot price to those in the TTF price varied by month (the lower part of Figure

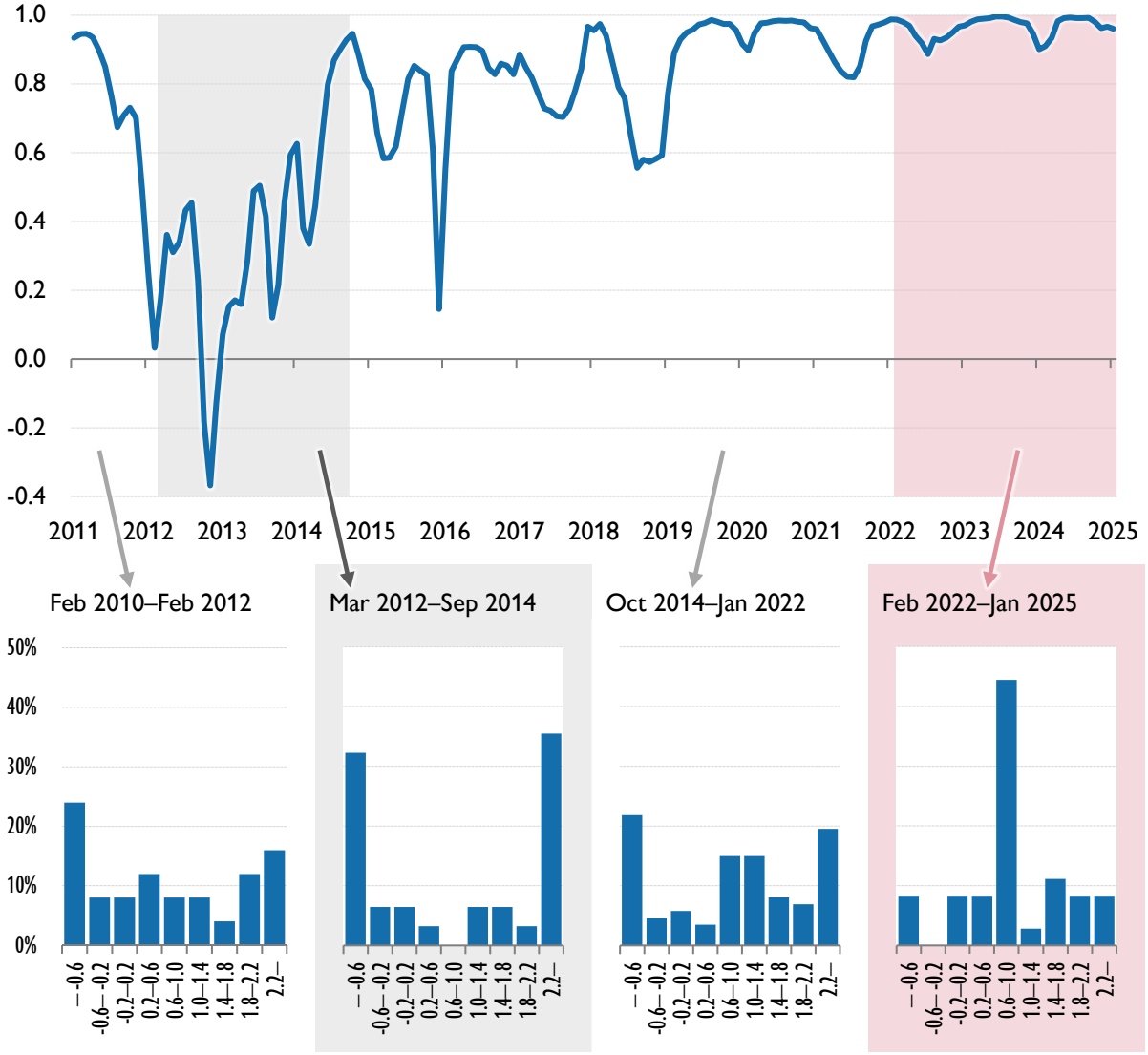
[2] The other factors include an increase in LNG supply (capacity) in gas-producing countries other than the United States, gas-consuming countries' development of LNG reception and regasification terminals, and the Japan Fair Trade Commission's opinion that destination clauses and profit distribution for traditional long-term LNG procurement contracts could have problems regarding the Antimonopoly Act.

[3] Prices of the front-month futures contracts

[4] 12-month moving correlation

5). In recent years, however, their co-movement has increased. Their correlation coefficient has risen close to 1. Ratios of changes in the Northeast Asian LNG price to those in the TTF price have concentrated in the 0.6–1.0 range.

Figure 5 | Correlation coefficient between the Northeast Asian LNG spot and TTF prices (upper) and distribution of ratios of changes in the Northeast Asian LNG spot price to changes in the TTF price (lower)



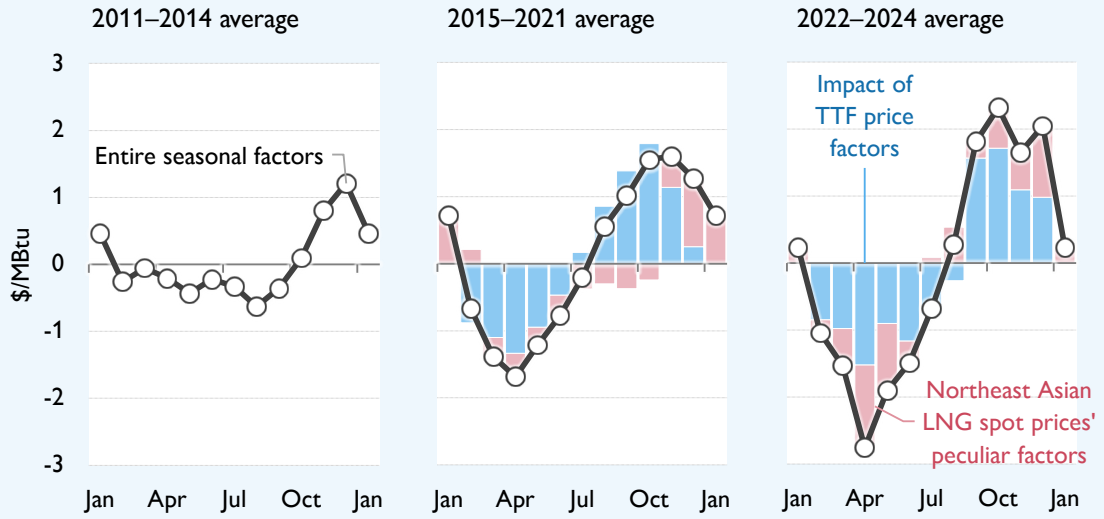
Note: The correlation coefficient represents the 12-month moving correlation.
Source: Computed from Independent Commodity Intelligence Services (ICIS), Intercontinental Exchange and European Central Bank data

Box 1 | Seasonality of the Northeast Asian LNG spot price

As natural gas demand is greatly affected by temperature changes, natural gas prices are identified as having some seasonality. Given that the seasonality is based on changing demand, the pattern and degree of the seasonality may change in line with structural demand changes, instead of staying constant permanently. As natural gas-fired power generation has expanded, the Northeast Asian LNG spot price remarkably tends to decline in spring, when demand for electricity and therefore natural gas for power generation decreases. In winter, when demand for natural gas for heating (for direct combustion or power generation) increases, however, the price tends to rise. On the other hand, the TTF price begins to rise as early as September, reflecting Europe's cool climate and stock building towards winter.

The increasing co-movement between the Northeast Asian LNG spot and TTF prices may affect their seasonality. If the link between the Northeast Asian and European markets becomes closer, the pattern and fluctuations of the seasonality of the Northeast Asian LNG spot price may change under the greater influence of the TTF price.

Figure 6 | Seasonal factors in the Northeast Asian LNG spot price



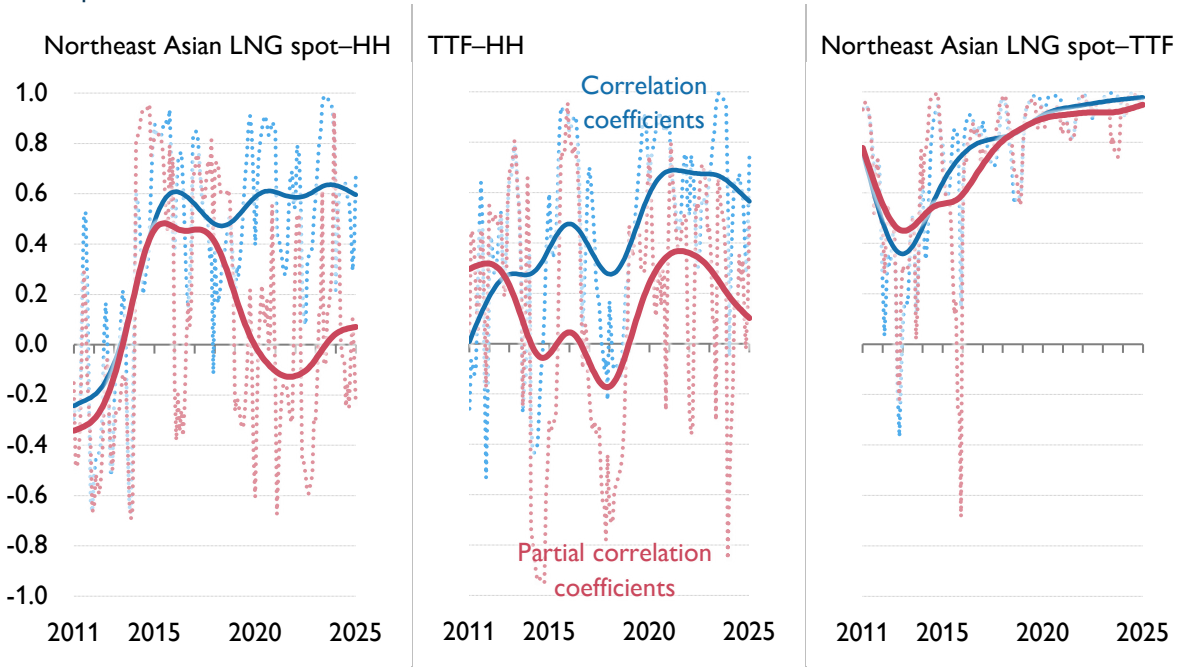
Notes: Based on the X-13ARIMA-SEATS seasonal adjustment program. The 'entire seasonal factors' are for the case in which the user-defined regression variable is not used. 'Northeast Asian LNG spot price's peculiar factors' are for the case in which the TTF price is used as the user-defined regression variable. The 'impact of TTF price factors' is the gap between the entire seasonal factors and the Northeast Asian LNG spot price's peculiar factors. The breakdown of seasonal factors is not made available for the 2011–2014 period, when the correlation between the Northeast Asian LNG spot and TTF prices was low.

The Henry Hub price's co-movement with the Northeast Asian LNG spot price and the TTF price has not increased

The rise of US LNG is considered a factor behind the increased co-movement between the Northeast Asian LNG spot and TTF prices. Contrary to a kind of instinctive expectation, however, the US benchmark Henry Hub (HH) natural gas price[5] has failed to increase its co-movement with the Northeast Asian LNG spot price or the TTF price. The Northeast Asian LNG spot and TTF prices, though posting a high correlation with the HH price occasionally, have not necessarily maintained such correlation over the medium term (Figure 7).

[5] Spot

Figure 7 | Correlation coefficients and partial correlation coefficients of the Northeast Asian LNG spot, TTF and HH prices



Notes: 12-month moving correlation. Dotted lines refer to original data and solid lines to trends.
Source: Computed from ICIS, Intercontinental Exchange, European Central Bank and U.S. Energy Information Administration data

The partial correlation coefficient[6] between the Northeast Asian LNG spot and HH prices, which was computed with consideration given to potential correlations between the Northeast Asian LNG spot, TTF and HH prices, failed to consistently post any large value, similar to the correlation coefficients. It has not increased so far; rather, its trend has remained close to 0.

The partial correlation coefficient between the TTF and HH prices shows a similar trend. Since the HH price is determined by supply and demand in the whole of North America, where the United States is connected to Canada and Mexico via pipelines, the HH price is still considered very local and is fluctuating differently from Asian and European natural gas market prices.

In contrast, the partial correlation coefficient between the Northeast Asian LNG spot and TTF prices posts almost the same trend as their correlation coefficient. Given the above, US LNG might have contributed to the growing co-movement between the Northeast Asian LNG spot and TTF prices, whilst the HH price itself has had no direct relation with them. Even if prices of US LNG exports bound for Northeast Asia[7] are considered roughly indexed to the HH price, it may be concluded that US LNG has played no role in directly determining the equilibrium price on the Northeast Asian LNG spot market. The supply and demand environment for the entire Northeast Asian LNG market is considered a key determinant of the Northeast Asian LNG spot price.

[6] For example, the partial correlation coefficient between the Northeast Asian LNG spot and HH prices indicates their correlation by excluding the TTF price's correlations with the Northeast Asian LNG spot and HH prices.

[7] Computed from data in U.S. Energy Information Administration "U.S. Natural Gas Exports and Re-Exports by Country". It must be noted that the computed prices are not limited to spot ones.

As the European natural gas price fluctuates by $1/MBtu, the Northeast Asian LNG spot price fluctuates by $0.75/MBtu

We used an error correction model[8] for an analysis to evaluate the current Northeast Asian LNG spot price in detail[9]. The following are the characteristics of the Northeast Asian LNG spot price as indicated by parameters gained through the analysis:

1/ It fluctuates by an average $0.75/MBtu in a month when the TTF price fluctuates by $1/MBtu,

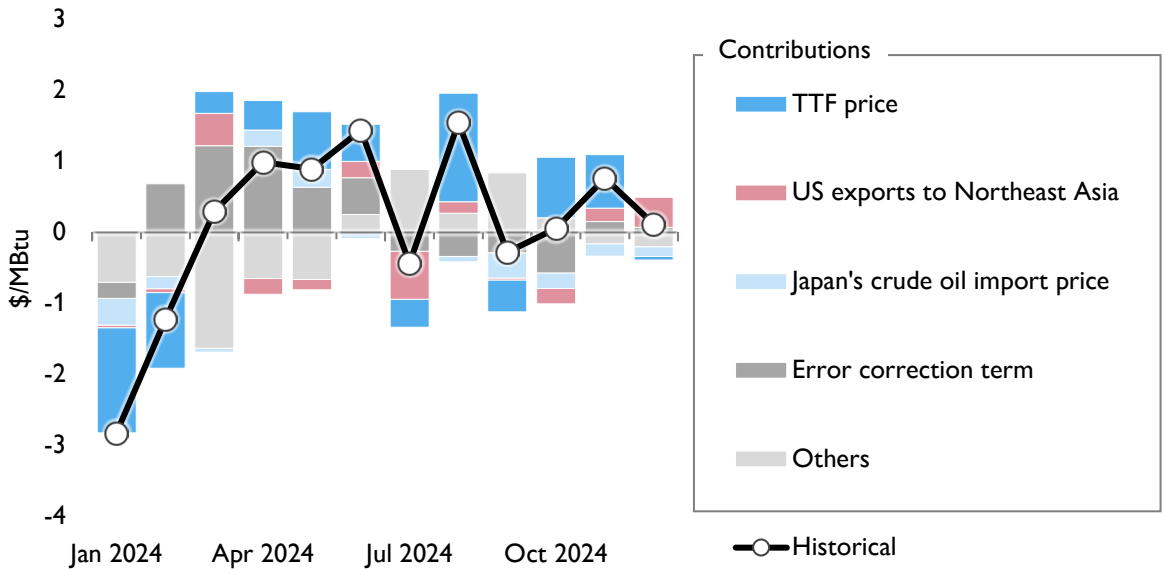
2/ It declines by $0.56/MBtu as US LNG exports to Northeast Asia increase by 1 Bcm, and

3/ It is identified as being somewhat affected by crude oil prices[10], increasing by $0.08/MBtu as the Japan crude cocktail (JCC) price rises by $1/bbl (about $0.17/MBtu).

When the TTF price declines in a month, only 65% of the deviation from the medium-term equilibrium level for the Northeast Asian LNG spot price is covered within the same month. The deviation takes one and a half months to be covered. When the TTF price increases, however, the deviation for the Northeast Asian LNG spot price is almost covered in one month. When the TTF price rises, market participants pay greater attention to the relatively high or low Northeast Asian LNG spot price, making it easier for the TTF price rise to be reflected in the Northeast Asian LNG spot price.

A breakdown of fluctuations in the Northeast Asian LNG spot price in 2024 based on the above characteristics indicates that a considerable portion of each fluctuation can be explained by the contribution of the TTF price fluctuation (Figure 8). Of the average $0.9/MBtu fluctuation in the Northeast Asian LNG spot price, the TTF price's contribution to the fluctuation accounted for an average as high as $0.7/MBtu. From March to December, when LNG prices were rising, as much as $4.3/MBtu of the $5.4/MBtu increase in the Northeast Asian LNG spot price was explained by the TTF price hike.

Figure 8 | Breakdown of contributions to Northeast Asian LNG spot price fluctuations



[8] The model's explanatory variables include an error correction term to indicate how a deviation (error) between an actual price level and the medium-term equilibrium price level is covered later.

[9] The period for modelling is between February 2022 and December 2024.

[10] Crude oil prices can be viewed as a substitute benchmark for LNG prices indexed to crude oil prices under many long-term LNG import contracts for Northeast Asia.

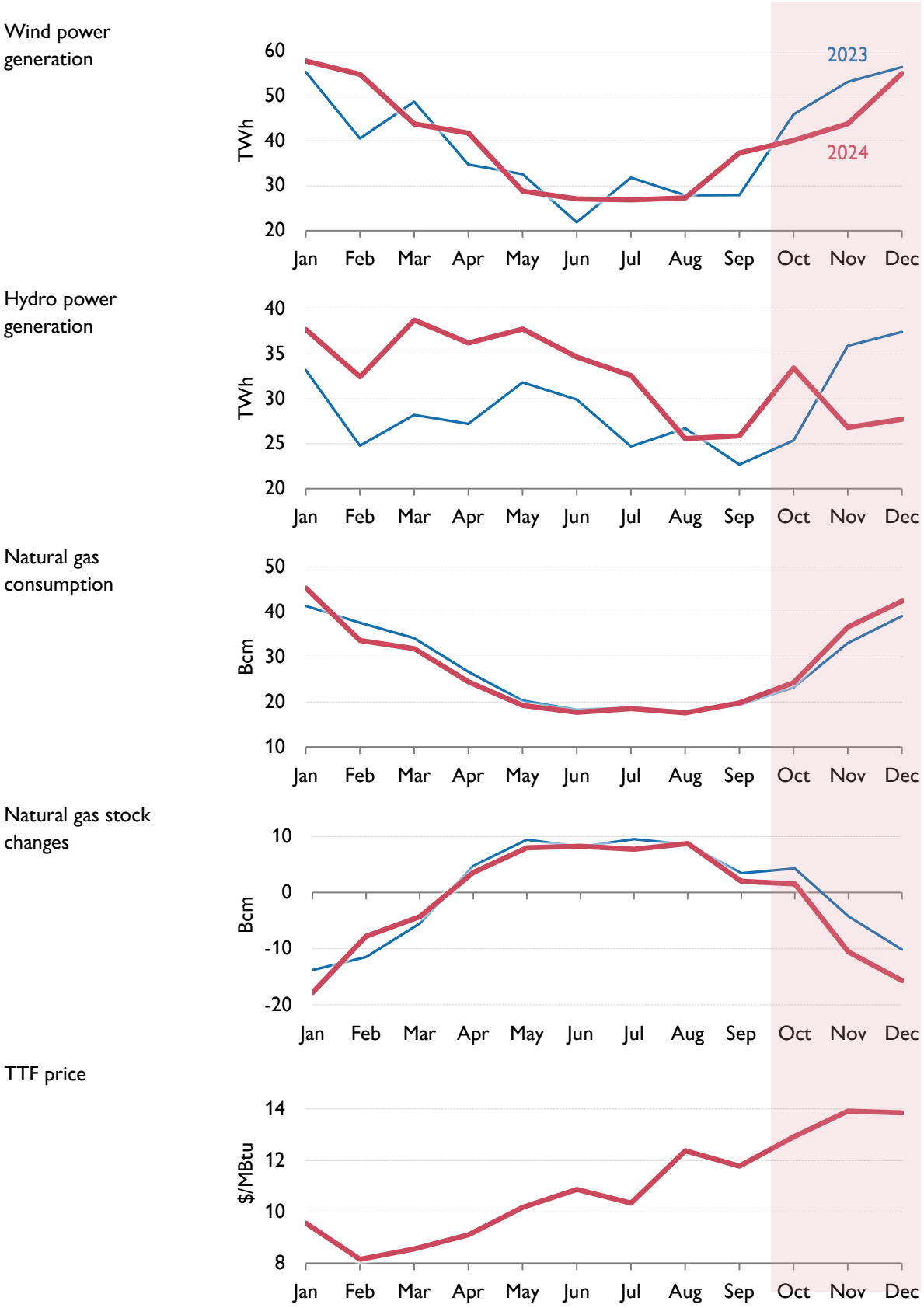
In contrast, the contribution of fluctuations in US LNG export volume is smaller than that of TTF price fluctuations. In a joint press conference with Japanese Prime Minister Ishiba, US President Trump said that Japan would soon begin to import US LNG at an unprecedented scale. While volume, timing and other specifics or the feasibility of such US LNG exports to Japan are uncertain, we have no choice but to conclude that it is difficult to expect that the direct impact of an increase in such US LNG exports alone would bring about a substantial decline in the Northeast Asian LNG spot price under the current market structure. If a massive increase in US LNG supply contributes to easing the supply-demand balance in the global natural gas/LNG market, it can be expected that LNG prices would generally decline.

Northeast Asian LNG spot price changes depending on European weather conditions

The average TTF price in the first half of 2024 stood at $9.4/MBtu, the lowest after Russia's invasion of Ukraine in February 2022. However, it followed an uptrend in the second half of 2024, topping $10/MBtu in each month of the half-year period. Particularly, it came to $13.9/MBtu in November and December, posting a 70% rise from the year's low of $8.2/MBtu in February. Behind the price hike was a sharp increase in natural gas demand. From autumn, especially in November, temperatures declined rapidly from relatively high levels, coinciding with a fall in wind power generation (in October and November) and in hydro power generation (in November) in the European Union (Figure 9). Reportedly, these developments led to a clear year-on-year increase in natural gas consumption and a steep dip in natural gas stock, affecting the market. Such a weather factor not only led to the TTF price rebound but also contributed to a $0.8/MBtu increase in the Northeast Asian LNG spot price in November through the co-movement.

This was not the first time that sluggish wind power generation triggered a rise in natural gas prices in Europe. In 2021, when affordable pipeline gas supply from Russia was decreasing, the TTF price shot up from $7.3/MBtu in January to $38.3/MBtu in December. When a long spell of windless and cloudy days in Europe leads to a decline in renewable energy power generation and a rapid increase in natural demand and prices, the developments exert a spillover impact on the Northeast Asian LNG spot price. Given that variable renewable energy power generation is certain to increase further, such a spillover effect or risk may become more frequent and greater.

Figure 9 | European Union's wind power generation, natural gas consumption and stock changes, and TTF price



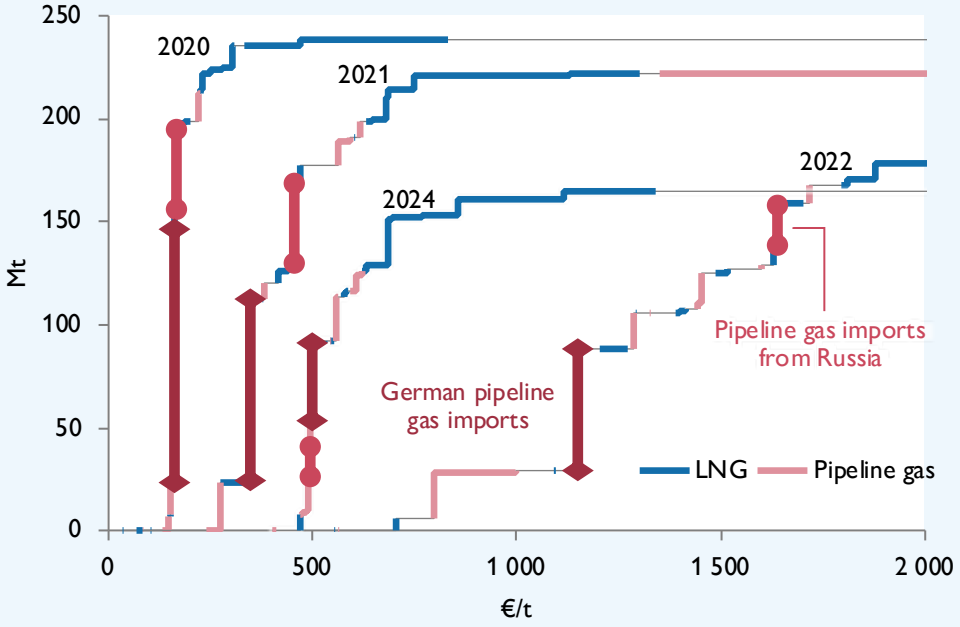
Note: Stock building is shown as positive values of stock changes and withdrawing as negative values.
Sources: Eurostat [Power generation, natural gas consumption and natural gas stock changes], computed from Intercontinental Exchange and European Central Bank data [TTF price]

Box 2 | Transformed European Union's natural gas import composition

The European Union depends on imports for about 90% of its supply of natural gas, the second largest energy source after oil in the region, as regional production has decreased. The composition of its natural gas imports has been greatly transformed in response to recent situational changes.

Earlier, the European Union, including Germany, had heavily depended on pipeline gas imports from Russia and benefited from their affordability. Reflecting European countries' policy of phasing down dependence on Russia for energy supply, however, the union's pipeline gas imports from Russia and Germany's overall pipeline gas imports, including those from Russia, in 2024 declined substantially (Figure 10). In place of pipeline gas, relatively expensive LNG (including Russian LNG) now plays an increasing role in Europe's natural gas supply.

Figure 10 | Composition of European Union's natural gas imports

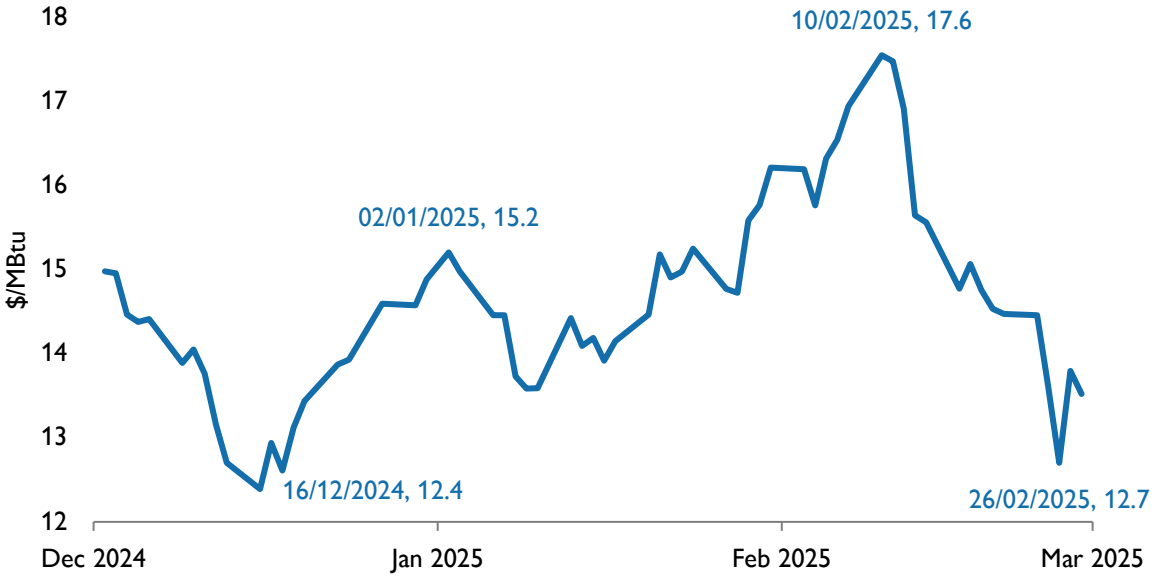


Notes: The figure covers published statistical data alone, failing to encompass all European Union's natural gas imports. Germany's pipeline gas imports, which are kept secret in Eurostat, have been roughly estimated based on the overall import average under the assumption of 48 MJ/kg. Data are annual.
Source: Computed from Eurostat pipeline/LNG import data by partner and data in Statistisches Bundesamt "Yearly natural gas imports"

The import curve's great rightward shift (price hike) seen in 2022 has been partially reversed. The curve's horizontal position may shift leftward or rightward depending on supply and demand conditions. It may shift leftward from the current position, reflecting price falls. On the other hand, the 30-year Europe-Russia relations after the Cold War have collapsed. Their early reconstruction cannot be expected. Even if a temporary ceasefire in Ukraine is realised, the structural vertical shift (regarding import sources) of the European Union's natural gas import curve may remain unchanged for the immediate future.

Recently, the TTF price has fluctuated wildly in response to rapid changes in the Ukraine situation[11] (Figure 11). After falling to $12.4/MBtu on 16 December 2024, the TTF price soared by $2.8/MBtu or 23% to $15.2/MBtu in only two weeks and rose by an additional $2.3/MBtu or 15% to 17.6/MBtu in one month. In only two weeks, however, the price dropped by $4.8/MBtu or 28% to $12.7/MBtu. Such TTF fluctuations spill over to the Northeast Asian LNG spot price.

Figure 11 | TTF price



Source: Computed from Intercontinental Exchange and European Central Bank data

The Northeast Asian LNG spot price narrowing the gap with the TTF price

Over the medium term, meanwhile, the Northeast Asian LNG spot price's excess[12] over the TTF price has gradually shrunk (Figure 12).

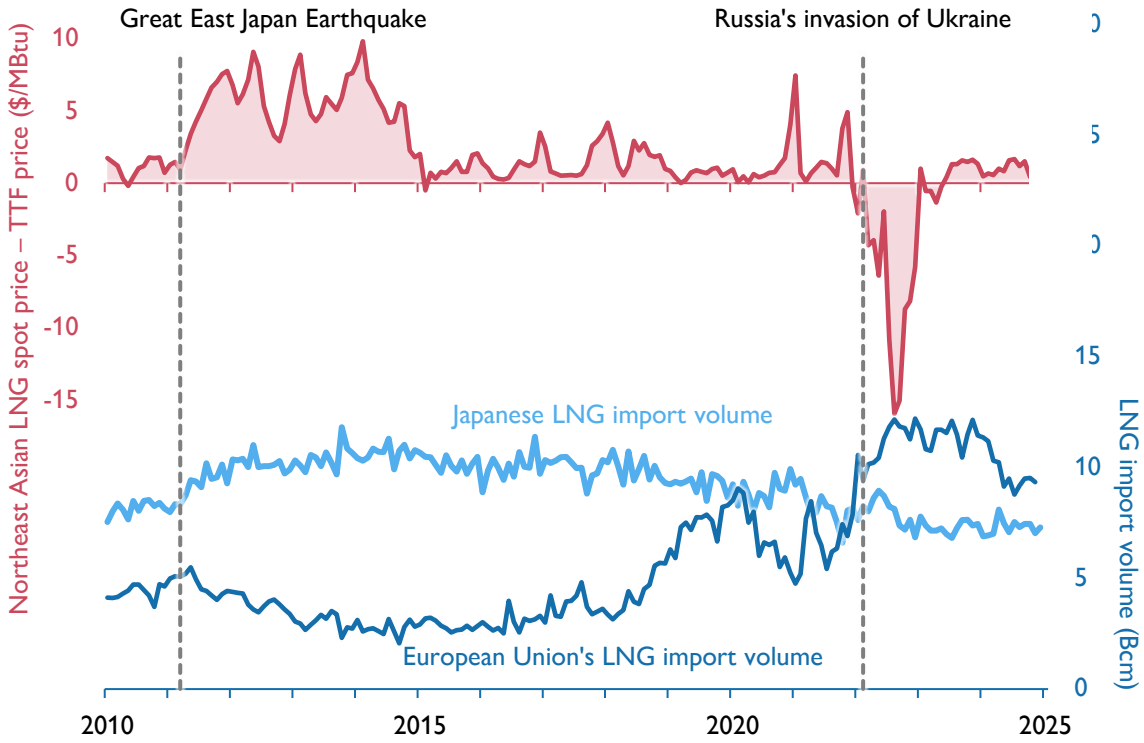
Between 2011 and 2014, the Northeast Asian LNG spot price was an average $5.5/MBtu higher than the TTF price. Then, a link between the Northeast Asian LNG spot market and the European natural gas market was weak, due partly to the LNG market's low liquidity and flexibility. Against this background, Japan increased its LNG demand by the order of 10 Mt or 10 Bcm per year to make up for a steep fall in nuclear power generation following the Great East Japan Earthquake, apparently contributing to the high Northeast Asian LNG spot price.

Recently, however, the Northeast Asian LNG spot price's excess over the TTF price has considerably narrowed, with the exception of the period in which the TTF price shot up as European countries desperately bought natural gas in the wake of Russia's invasion of Ukraine in 2022. Whilst price spikes were seen occasionally, the Northeast Asian LNG spot price's gap with the TTF price shrank to an average $0.9/MBtu in 2024.

[11] In late 2024, the Russi-Europe pipeline gas supply route via Ukraine was shut down in addition to the Nord Stream and another via Belarus that were closed earlier. In February 2025, the US and Russian foreign ministers held talks on a ceasefire in Ukraine. In the same month, Ukrainian President Volodymyr Zelensky met with US President Donald Trump, but their relations worsened then. In March, the US and Ukrainian foreign ministers met to discuss a ceasefire.

[12] Liquefaction and other processes, which are not required for pipeline gas, are necessary for LNG supply. Given such cost gap, the Northeast Asian LNG spot price cannot be expected to become equal to the TTF price represented by pipeline natural gas supply under the same conditions in peacetime.

Figure 12 | The Northeast Asian LNG spot price's gap with the TTF price, and Japanese and European Union's LNG import volume



Notes: Import volume data are seasonally adjusted. The European Union's import volume covers gross trade, including trade between the union members.
Sources: Computed from ICIS, Intercontinental Exchange and European Central Bank data [price gap]. Computed from Ministry of Finance "Trade Statistics" and JODI-Gas World Database [import volume]

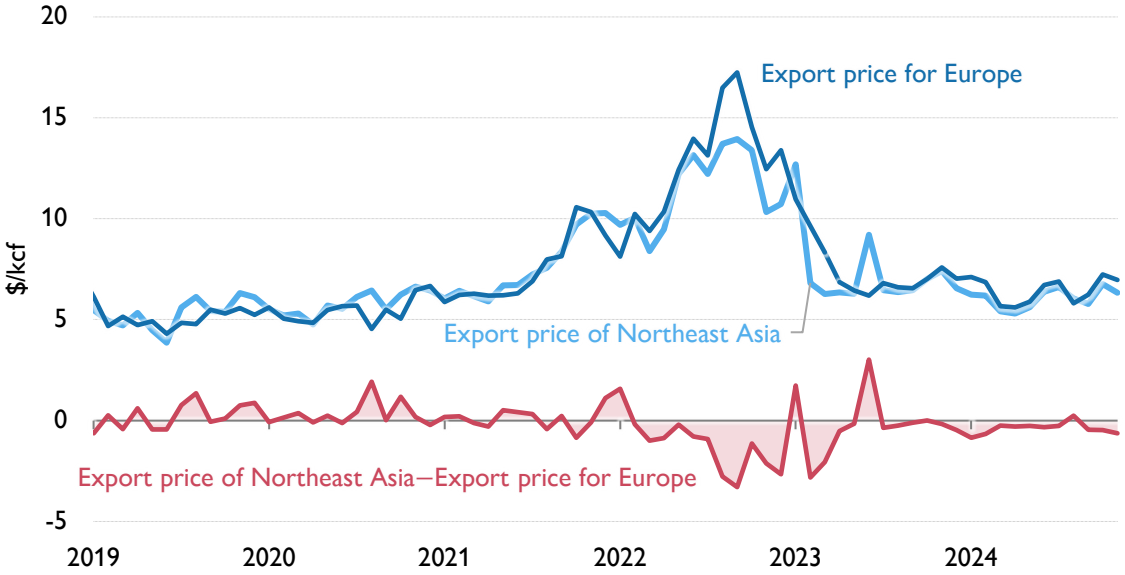
Will US LNG contribute to lowering the Northeast Asian LNG spot price?

As the United States has emerged as a thick, soft 'brace', the link between the Northeast Asian LNG spot and TTF prices has increased. Northeast Asian natural gas users may now expect that the price gap between the Northeast Asian and North American markets will narrow through a decline in Northeast Asian prices. However, whether US LNG's quantitative expansion could bring about the convergence of North American and Northeast Asian market prices must be carefully examined.

The HH price has had little correlation with the Northeast Asian LNG spot price, as shown earlier. While US LNG links the Northeast Asian LNG spot and European natural gas markets, US LNG is not necessarily shipped to the two markets at the same price (Figure 13). Certainly, the US LNG price is benchmarked to the HH price. When LNG prices are high in LNG export destinations, however, LNG sellers may not choose to sell LNG on a spot basis at low prices based on the HH price (or to abandon excessive profits).

Northeast Asia's expansion of US LNG imports alone may not be enough for the region to procure LNG at affordable prices on a spot basis. Unless a supply structure is developed for Northeast Asia to procure natural gas (or alternative energy sources) at competitive prices from suppliers other than the United States, the region may fail to benefit fully from the low HH price through US LNG imports.

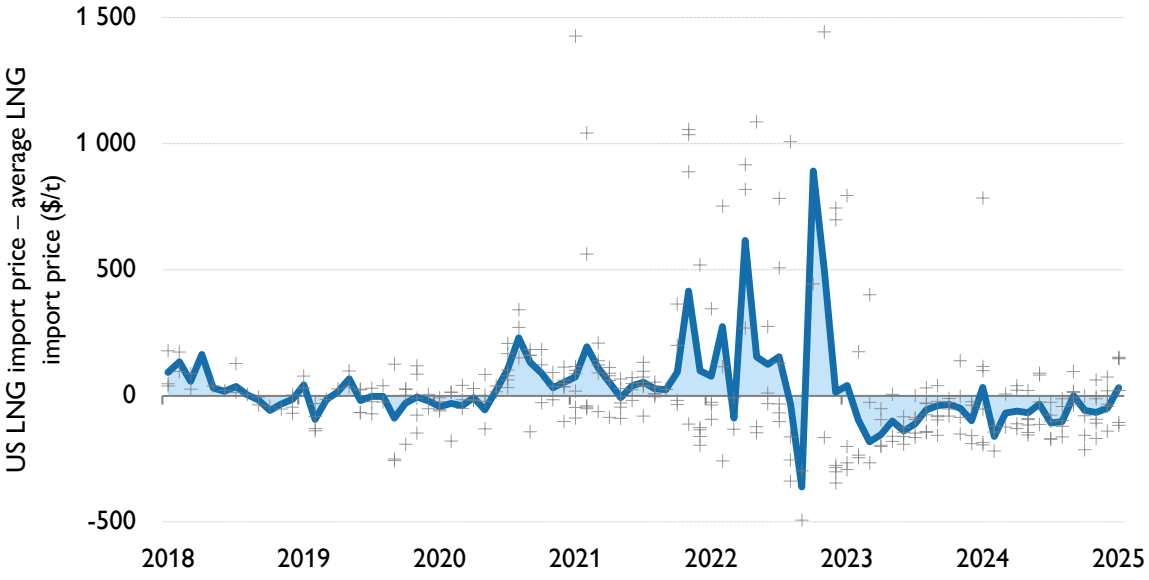
Figure 13 | Gaps between prices of US LNG exports to Northeast Asia and Europe



Note: Data cover both spot and long-term contract transactions.
Source: Computed from U.S. Energy Information Administration data

Contrary to some people's expectations, US LNG is not always affordable (Figure 14). US LNG supply to Japan will be required to be implemented in line with the United States-Japan Joint Leaders' Statement: 'The two leaders announced their intention to strengthen energy security by unleashing the United States' ***affordable and reliable*** energy and natural resources, and by increasing exports of U.S. liquefied natural gas to Japan ***in a mutually beneficial manner***'. This naturally refers not only to LNG shipments from existing US plants but also to those from an Alaskan LNG project that Mr Trump at the meeting with Mr Ishiba cited as subjected to talks on US-Japan cooperation.

Figure 14 | Gaps between US and average LNG import prices



Notes: Cross-shaped points represent US LNG import price data by customs office and the line indicates their averages. Both spot and long-term transaction prices are covered.
Source: Computed from Ministry of Finance "Trade Statistics" and other data

In constructing better relations with the United States as Japan's ally, Japan may have to brush up by developing and enhancing a competitive LNG procurement environment.

Contact: report@tky.ieej.or.jp