

Future of LNG **security, affordability, and decarbonization**



Discussion Paper for the LNGPCC 2024

October 6, 2024

Timetable for LNGPCC 2024

LNGPCC 2024 Agenda

Session 1: Government Session

8:00 – 10:20	Speech Part Opening speech - Yoshifumi Murase, Commissioner, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry (METI) Keynote speech - Keisuke Sadamori, Director, Energy Markets and Security Directorate, International Energy Agency (IEA) Guest speech - Guest Speech from Senior Representatives from Governments and National Oil & Gas Companies Ceremonial Part Speech - Ichiro Takahara, Chairman and CEO, Japan Organization for Metals and Energy Security (JOGMEC), including the announcement of the first report of CLEAN initiative. Announcement of expansion of CLEAN initiative Announcement of LNG Importers' initiative alliance for methane mitigation from the LNG value chain Announcement of Japan-Italy Gas Cooperation
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Session 2: Public-Private Session

10:20 – 13:00	Keynote Speech - Daniel Yergin, Vice chairman of S&P Global (Video Message) - Jean Abiteboul, President, GIIGNL Panel Discussion 1 [10:40am-11:20am] “Public and Private Efforts to Enhance Gas Security and the Role of Gas Reserve Mechanisms” Moderator: - Akos Losz, Lead Gas Analyst, IEA Panel Discussion 2 [11:30am-12:10pm] “Technology Progress Toward Decarbonizing the LNG Value Chain and Challenges in Developing a Roadmap” Moderator: - Gunnar Steck, Owner of Enquidity Panel Discussion 3 [12:20pm-13:00pm] “The Role of Financing in Ensuring Growth of a Stable LNG Market” Moderator: - Yuriy Humber, President of Yuri Group and Founder of Japan NRG Closed Roundtable hosted by IEEJ under the Chatham House rule [10:40am-13:00pm] Host - Ken Koyama, Chief Economist and Senior Managing Director, The Institute of Energy Economics, Japan
13:05 – 13:15	Closing speech

The History of LNGPCC

LNGPCC is an international LNG conference initiated by Japan's Ministry of Economy, Trade and Industry (METI). The inaugural LNGPCC in 2012 brought together a wide range of stakeholders from producing and consuming countries for the first time. Over the ensuing decade, LNGPCC served as an important global forum to discuss issues concerning supply stability, energy security, and the development of the LNG market.

In 2023, the International Energy Agency (IEA) joined forces with METI to co-host the 12th edition of LNGPCC. LNGPCC 2023 focused on further strengthening cooperation among international stakeholders in both the public and private sectors, and how to ensure a stable LNG supply to prevent future energy crises. A post-conference report, titled *LNG Strategy for the World* summarized the discussions and outlined challenges and opportunities for strengthening LNG security and decarbonizing the LNG value chain.¹ During a special session, JERA, KOGAS, and the Japan Organization for Metals and Energy Security (JOGMEC) launched the Coalition for LNG Emission Abatement toward Net-zero (CLEAN), a joint public-private initiative to reduce methane emissions. The European Commission (EC) and the governments of the United States, Korea, Australia, and Japan published a joint statement emphasizing the importance of methane emission reduction measures and expressed their support for the CLEAN initiative.

The Agenda for LNGPCC 2024

The main theme of LNGPCC 2024 is "The Future of LNG – Security, Affordability, and Decarbonization". The Public-Private session of the conference will focus on the following topics:

- ① Public and private efforts to enhance gas supply security and the role of gas reserve mechanisms.
- ② Technological progress towards decarbonizing the LNG value chain and the challenges in developing a roadmap.
- ③ The role of financing in ensuring the growth of a stable LNG market.
- ④ The impact of various demand scenarios associated with different levels of climate ambition on policy and corporate behavior.

1. Ministry of Economy, Trade and Industry, LNG Strategy for the World, July 18, 2023, <https://www.meti.go.jp/press/2023/07/20230719001/20230719001-1.pdf>

Background Note for the Public-Private Dialogue

Russia's full-scale invasion of Ukraine caused widespread disruption in energy markets and the global economy by driving up energy prices, including those of gas and electricity, fueling inflation, and heightening geopolitical risks. For a just and orderly energy transition, countries need to balance three challenges: energy security, affordable energy prices, and climate action, collectively known as the energy trilemma. The 2022-2023 energy crisis brought energy security and affordability back to the forefront, serving as a stark reminder that both must be ensured throughout the entire process of energy transitions.

Demand for LNG is growing, particularly in Asia, and in a scenario based on today's policy settings, is expected to increase steadily through 2030. However, the future demand trajectory remains uncertain, and the role of natural gas and LNG in energy transitions remains subject to a wide range of possible outcomes, depending on the sector, geography and timeframe. Emerging technological trends, such as the growth of data centers and AI, can widen these uncertainties even further.

Even in ambitious climate-focused scenarios, natural gas and LNG continue to play a considerable role in the global energy system in the coming decades. Natural gas-fired power plants, as dispatchable sources of electricity, can provide flexibility to integrate variable renewables such as solar and wind energy worldwide. In emerging and developing economies, particularly in Asia, gas and LNG can help facilitate the transition away from coal. Various technology options are being considered to reduce emissions across the LNG supply chain, such as carbon capture and storage (CCS), the electrification of LNG plants, and the co-firing of hydrogen in gas-fired power plants. A roadmap for decarbonizing the LNG value chain is urgently needed to address the future role of LNG technologies in energy systems.

The different possible trajectories for gas demand creates a dilemma for large, capital-intensive LNG projects. Developing gas and LNG security measures to ensure that supply is flexible and sufficiently able to meet demand will be critical to addressing the energy trilemma. The value of gas reserve mechanisms for this purpose was recognized in the IEA Ministerial Communique and the G7 Climate, Energy and Environment Ministers' Meeting Communique in 2024. To support the development of a liquid global LNG market, it is important to increase the flexibility of LNG trading. This can be achieved through cooperation between producers and consumers, more flexible LNG contracts, and the removal of destination restrictions. These measures could facilitate the role of LNG in emerging and developing countries. At the same time, securing long-term LNG

contracts from diverse supply sources can contribute to the energy security of consumer countries.

LNG's status as a fossil fuel makes project financing more difficult for lenders, who face growing internal and external pressures to reduce financed emissions. New financing methods, such as direct investment and project bonds, have emerged in recent years, offering a broader array of financing options beyond traditional project finance. Such financing models should take into account the broader imperative to reduce energy-related GHG emissions in line with national and global targets by developing lending criteria that ensures that gas and LNG projects play a constructive role to this end.

The IEA Work Plan on LNG

In 2024, the IEA started a METI-funded, two-year work programme on gas supply security and the role of gas and LNG in the energy transition. The aim of the work plan is to reduce the risk of a recurrence of the 2022-2023 energy crisis and to foster global gas security in conjunction with an orderly energy transition.

The IEA work plan includes a detailed assessment of lessons learned from past energy crises, a proposed study on voluntary gas reserve mechanisms, sensitivity analyses around long-term gas and LNG demand, and a roadmap for low-carbon LNG technology deployment.

1. Lessons Learned from Past Energy Crises

The IEA will synthesize lessons from previous gas crises, particularly the 2022-2023 energy crisis. The analysis will identify contributing factors to past crises, assess the responses of companies and governments, and provide guidance for future crisis management through a set of lessons and recommendations derived from past experiences.

2. Study on a Voluntary Gas Reserve Mechanism

In February 2024, the IEA Ministerial Meeting recognised the importance of well-functioning global LNG markets in general, and gas reserve mechanisms in particular. At the same meeting, IEA member countries requested the IEA Governing Board to exchange information and analyse ways to enhance gas market flexibility, transparency, and supply security, including through enhanced gas storage and reserve mechanisms. Well-designed gas reserve mechanisms, whether physical or virtual, can enhance gas supply security and price stability. The IEA will host a series of workshops to evaluate different modalities for such reserve mechanisms. Building on an extensive consultation process, the IEA will provide an analysis on potential frameworks for voluntary gas

reserve mechanisms presented in a special report.

3. Sensitivity Analysis of Long-Term Gas and LNG Demand

The long-term outlook for gas and LNG demand is highly uncertain. The IEA's long-term scenarios, as presented in the World Energy Outlook, offer a range of outcomes under a set of macroeconomic and policy assumptions. However, additional uncertainty arises for gas and LNG demand from factors such as inflation, economic growth, renewable energy costs, and the cost of building and maintaining infrastructure. As part of this work stream, the IEA will conduct a sensitivity analysis to explore how its main long-term scenarios may change if the underlying assumptions are altered. This analysis aims to help companies and governments better assess market risks and inform their strategies and action plans towards achieving net-zero goals.

4. Roadmap for Low-Carbon LNG Technology Deployment

Decarbonizing the LNG supply chain is essential for LNG to play any role in net zero transitions. The majority of greenhouse gas (GHG) emissions across the LNG value chain occur during combustion, while the remaining emissions, including methane, are generated in the upstream and midstream stages. Several technologies are available to decarbonize the LNG value chain from upstream to downstream. For upstream and midstream emissions, a range of methane abatement technologies, electrification of liquefaction facilities, and carbon capture and storage (CCS) can be deployed. For combustion emissions, decarbonization options include synthetic methane and the use of CCS in the production of hydrogen or in energy-intensive industries, among other solutions. However, uncertainties remain regarding the scope, cost, and emissions reduction potential of these technologies, and verification is needed to determine the most viable path toward decarbonization across the entire LNG value chain. It is also necessary to evaluate whether existing LNG facilities can accommodate new energy sources in a cost-effective and impactful manner. The IEA will conduct a study to develop a roadmap for the decarbonization of the LNG value chain, focusing on the upstream and midstream stages. This roadmap will serve as a guide for individual projects and can later be integrated into downstream decarbonization efforts, creating a comprehensive picture of decarbonization pathways throughout the value chain.

It is the shared hope of the IEA and METI that these studies will provide direction for LNG policy, enhance LNG market transparency, and ultimately contribute to the global energy transition while ensuring security and affordability at the same time.

Current LNG Market Trends and Lessons from the 2022-2023 Energy Crisis

Over the course of 2022 and 2023, the largest natural gas supply shock in history unfolded, developing from seemingly regional dynamics into a global shockwave in gas and wider energy markets. From the resulting gas crisis emerged a number of realities and lessons that are worth revisiting. Carried forward, these lessons learnt will be key in enhancing preparedness for future gas market crises.

The new realities of the global gas market after the crisis

Three fundamental realities were highlighted by the 2022-2023 energy crisis. The first is that gas markets, for all their integration and strengthening, remain vulnerable to factors far outside the realm of market fundamentals. Russia's full-scale invasion of Ukraine in February 2022 was followed by a drastic reduction in Russian pipeline natural gas deliveries to the European Union and Europe overall. Previously accounting for around 35% of the EU's annual gas supply, Russian pipeline volumes dropped by 120 bcm over the 2022-2023 period, an unprecedented loss of supply in globally traded gas volumes. Beyond technical or economic factors, European natural gas supply security was undermined by geopolitical instability.

The second reality is the double-edged nature of an increasingly liquid, flexible, and global gas market. While a rapidly expanding LNG market has allowed for an increasingly global response to regional imbalances, regional imbalances are also more likely to have global repercussions. LNG flows were quick to shift in response to the Russian supply shock in Europe, with the continent taking in about 50% more LNG in 2022 and 2023 than in the years immediately preceding the supply shock. Within a short period, LNG had become Europe's baseload source of gas supply, a role previously held by the continent's main pipeline gas suppliers, first among them Russia. However, while the LNG market response alleviated supply tensions in one market, it had an equivalent and opposite effect elsewhere—thus is the reality of market interconnectedness. Asian and South American LNG imports fell in 2022 and, while a share of this decline also had fundamental roots—such as Covid-related lockdowns in China—much of it also stemmed from affordability issues in smaller Asian gas markets. European willingness to pay for incremental and limited LNG volumes edged out more price-sensitive markets as global spot LNG prices soared to new highs. In the increasingly globalized market that LNG has become, the reverberations of regional fundamentals are felt globally, notably through the spot market.

The third reality to resurface relates to how markets balance. The abrupt and drastic cut in Russian pipeline gas deliveries to Europe not only eliminated substantial

volumes from the global market, but also represented the loss of a significant source of regional supply-side flexibility that had a global reach. Russian upstream assets have the technical capacity, and European long-term contracts had the necessary flexibility, to allow for monthly and annual delivered volumes to fluctuate in response to demand dynamics and the price competitiveness of alternative supply. In parallel to this flexibility loss, relatively few incremental internationally tradeable volumes came to market—apart from those already slated to come online, notably from new LNG projects—as the crisis unraveled. In the absence of a significant supply response, demand curtailment therefore emerged as the ultimate balancing variable, not only in those markets from which LNG was redirected, but also in those markets that clocked record high LNG imports.

In Asia, this manifested as rolling blackouts across more vulnerable markets like Bangladesh and Pakistan, as fuel switching in the power sector was not always sufficient to compensate for reduced access to LNG. In India, lower LNG imports led to a significant ramp-up in coal-fired power generation and to gas-to-oil switching in industry. Ultimately, reduced access to LNG and higher prices for those spot volumes still imported added a fiscal burden on markets in the region and led to a scramble for alternative fuel options across various sectors.

In Europe, total annual gas demand recorded its steepest drop in history through the crisis as industrial activity slowed significantly, people adopted more conservative heating habits and renewable and nuclear power capacities ramped up, paring back the demand for gas in power generation. Mild winter weather also played a role in easing gas demand in the winter periods, but the scars of high spot gas prices and industrial demand destruction remain visible in 2024.

Demand took on the role of balancing the global gas market through the supply shock, and with relatively few remaining traditional supply-side flexibility options, it is set to remain a key backstop for the market. What's more, the lack of supply-side flexibility in gas markets is likely to continue engaging flexibility levers in parallel energy markets across both supply and demand. Gas market fluctuations will impact other markets, just as fluctuations in other markets will impact gas markets. As such, effective gas and LNG security of supply solutions will have to take parallel energy market realities into account.

Lessons from the post-crisis policy response

Beyond these new market realities, governments' market and policy interventions in response to the crisis also provide lessons for future crisis preparedness. In Europe, these interventions touched both infrastructure and the functioning of the market,

playing into some of the continent's long-standing strengths as a gas market, namely ease of access, barrier-free trading and gas-on-gas competition from multiple supply sources. Numerous floating regasification terminals were commissioned and connected in record time, and existing terminals were expanded to enable increased LNG inflows. The European Union also brought online new interconnectors during the crisis and, although these cross-border capacities were initiated before the crisis, they represented a longer-term commitment to maintaining the physical building blocks of a robust gas market.

The EU-level policy response was also strong, targeting winter preparedness – notably through storage targets, gas saving measures and solidarity agreements – and with a combined national and supra-national approach. Member States were responsible for enacting EU-level targets according to their individual policy and market structures, providing flexibility in achieving common aims. While many policy and regulatory initiatives proved to strengthen the foundational principles of the EU gas market, not all national-level moves worked in the same direction. The way in which storage facilities were filled precipitously in some markets in the run-up to winter 2022/23 raised questions about the potential price and financial implications of such market interventions. Furthermore, while solidarity agreements and infrastructure build-out aimed at safeguarding the flow of gas between member states, other national-level moves did the opposite, raising the cost of cross-border gas trade through extra charges, for example. From these various interventions, much can be studied in establishing best practices in responding to future gas crises.

In Asia, interventions played into tried-and-tested formulae for supply security. Relying on LNG buyers' strong position in the market, Japan introduced the Strategic Buffer LNG, allowing for the government to redirect LNG cargoes toward supply-constrained utilities in certain extreme market situations. Singapore introduced a Standby LNG Facility, reserving power generators certain volumes in supply crunch situations. Japan has also shown a continued interest in locking in long-term LNG contracts from diverse supply sources, a lever of supply security which its market players have long adhered to. Policy responses also stretched beyond the national scope and touched on international collaboration, with Japan signing MoUs on emergency cooperation with various Asian countries. While such elements may not have yet been put to the test, they highlight an important route for future crisis preparedness: solutions are unlikely to be found in isolation.

Despite the robustness of gas market design and the combination of policy and market action across different regional gas markets, the 2022-2023 global gas supply shock still tested the limits of the existing global natural gas security architecture. Global gas and LNG markets showed their effectiveness, providing price signals of new magnitudes

in response to an unprecedented situation, but the intensification of competition for a reduced pool of globally traded natural gas had widespread consequences for the economy at large. Industrial activity slowed, access to stable electricity supply faltered and the price shock not only rippled to adjacent energy markets, but also fed into global inflationary pressures. Minimizing the negative impacts of future natural gas crises will require working with the market, but it will also rely on efficient policies and innovative international collaborative mechanisms. Reflecting on this past crisis will be invaluable in constructing future crisis preparedness.

Introduction of the Theme of Panel Discussions and Key Questions

Section 1. “Public and Private Efforts to Enhance Gas Security and the Role of Gas Reserve Mechanisms”

KEY QUESTIONS

- What measures can governments and companies take to further strengthen gas supply security?
- What role can the IEA play in ensuring security in the LNG market in the future?
- What types of cooperation are feasible among consumers and between producers and consumers?



Moderator

Akos Losz

Lead Gas Analyst, IEA



Panelists

Tahir Faruqui

General Manager, Head of Origination
- LNG and member of the Leadership
Team for Shell's Global LNG Marketing
and Trading business, Shell



Panelists

YAO Yumiko

Executive Officer, Senior General
Manager of LNG Business
Department,
Tokyo Gas Co., Ltd.



Panelists

Paramate Hoisungwan

Advisor, ASCOPE



Panelists

NISHIZAWA Hitoshi (Toshi)

SVP, LNG Division
JERA Co., Inc.



Panelists

Matthew Baldwin

Deputy Director-General, DG ENER,
European Commission

Section 2. “Technology Progress Toward Decarbonizing the LNG Value Chain and Challenges in Developing a Roadmap”

KEY QUESTIONS

- What challenges do countries, businesses, and financial institutions face in terms of technologies and costs to achieve low-carbon transition, and how could they be resolved?
- What elements should be included in the IEA guidelines for a low-carbon roadmap? What are the hurdles for project operators to develop decarbonization plans based on the guidelines? How can governments and companies contribute to their development?
- What incentives could be offered for the establishment and expansion of a low-emission or carbon neutral LNG certification, and what conditions and environment are needed for the certification to be used from the customer's perspective?



Moderator
Gunnar Steck
Owner of ENQUIDITY



Panelists
MURAOKA Tomohide
Associate Executive Officer / Chief
Engineer, JGC Holdings



Panelists
Anatol Feygin
Executive Vice President and Chief
Commercial Officer of Cheniere



Panelists
Hamed Al Naamany
CEO, OmanLNG



Panelists
UCHIDA Makoto
Senior Managing Director,
Japan Bank for International
Cooperation (JBIC)

Section 3. “The Role of Financing in Ensuring Growth of a Stable LNG Market”

KEY QUESTIONS

- What are the current challenges faced by financial institutions in financing LNG projects? How can the low-carbon roadmap contribute to addressing issues related to managing financed emissions and aligning with Net Zero goals?
- Are non-traditional financing methods proven to be effective?
- What is the role of public financial institutions in sustaining investments and financing in the LNG sector? What support and institutional reforms are necessary from public financial institutions to meet the needs of their users and stakeholders?



Moderator

Yuriy Humber

President of Yuri Group and Founder
of Japan NRG



Panelists

IKEDA Shuhei

Operating Officer & General
Manager, Project Finance
Department, Mizuho Bank, Ltd.



Panelists

Andrew (Andy) R. Elliott

President, ExxonMobil LNG Asia
Pacific



Panelists

KINOSHITA Naoshige

Deputy Head and Lead Program
Coordinator, Asia External Representation
Office of African Development Bank



Panelists

De la Rey Venter

CEO of MidOcean Energy



Panelists

YOSHIOKA Takashi

Senior General Manager, Structured and
Trade Finance Insurance Department,
Nippon Export and Investment
Insurance (NEXI)

Closed side event

**Roundtable hosted by IEEJ under the Chatham House rule
- Impact of various demand scenarios assuming the different climate
actions on policy and corporate behavior-**



Host

KOYAMA Ken

Chief Economist and Senior Managing Director, The Institute of Energy Economics,
Japan

ANNEX

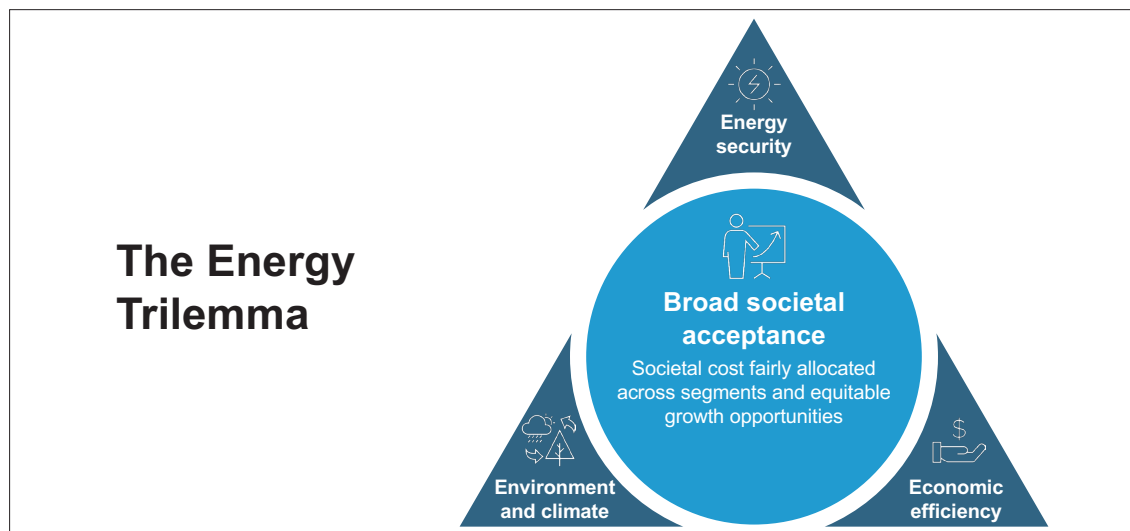
Global LNG Market Trends²

Global Perception of Natural Gas and LNG

Since the full-scale Russian invasion of Ukraine, the energy market has been disrupted by global inflation and geopolitical risks, resulting in a tight energy supply, a demand crunch, and a sharp rise in energy costs. Throughout the crisis, countries have reaffirmed the importance of energy security.

Countries will be required to balancing three competing challenges: energy security, affordable energy prices, and climate change mitigation, collectively known as the energy trilemma. Overcoming them is an important energy policy goal. It is also necessary to achieve a just and orderly energy transition, which happens when energy challenges are accepted broadly because societal costs and growth opportunities are allocated equitably.

Exhibit 1: The Energy Trilemma



Provided methane leaks across the supply chain are kept sufficiently low, natural gas and LNG is a cleaner-burning fuel than coal and oil. Moreover, gas infrastructure, such as pipelines, LNG facilities, and power plants, can potentially be repurposed to support the deployment of low-emission gases, such as biomethane, hydrogen, and hydrogen-based fuels. The LNG value chain has already been established. LNG can support the expansion of energy demand, especially in emerging countries, and play a role in overcoming the energy trilemma while ensuring just and orderly energy transitions.

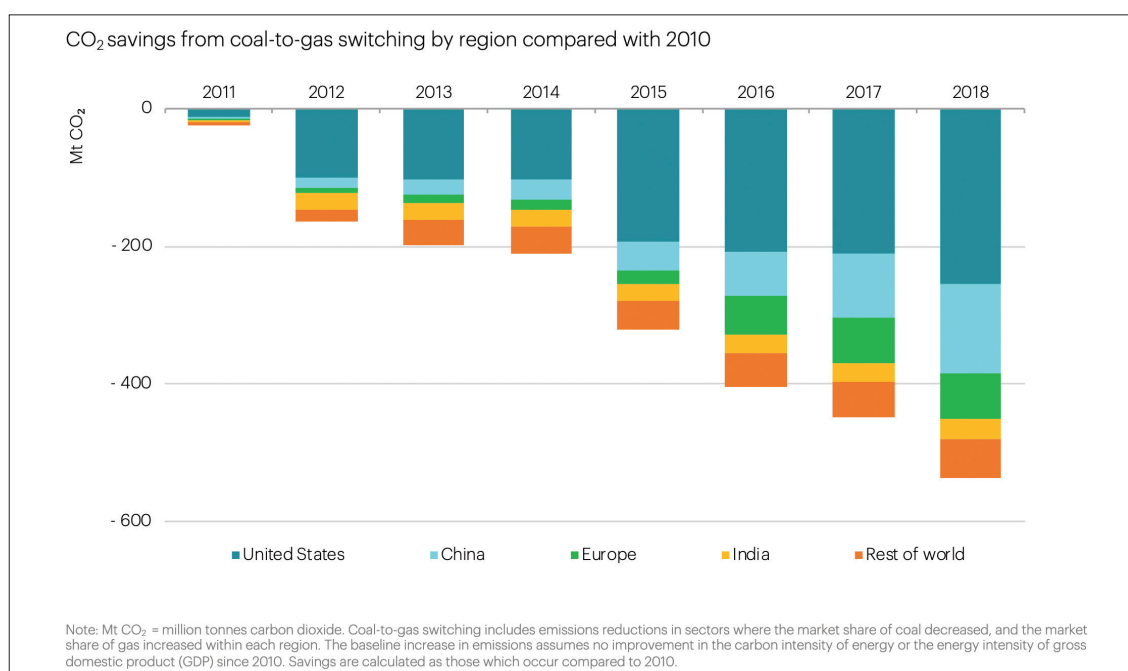
2. The IEA's views on the outlooks for gas markets and investment are summarized in a 2023 report prepared at the request of the Japanese G7 Presidency. <https://www.iea.org/reports/outlooks-for-gas-markets-and-investment>

Role of Natural Gas and LNG in the Future Energy Mix

Countries around the world are promoting the use of renewable energy for achieving net zero emissions, but the adoption rates still vary. The amount of power generation from variable renewable sources like wind and solar PV fluctuates depending on the season, day, and time, leading to mismatches in supply and demand. Natural gas-fired power plants provide flexibility to fill such gaps and integrate variable renewable sources in the power system.

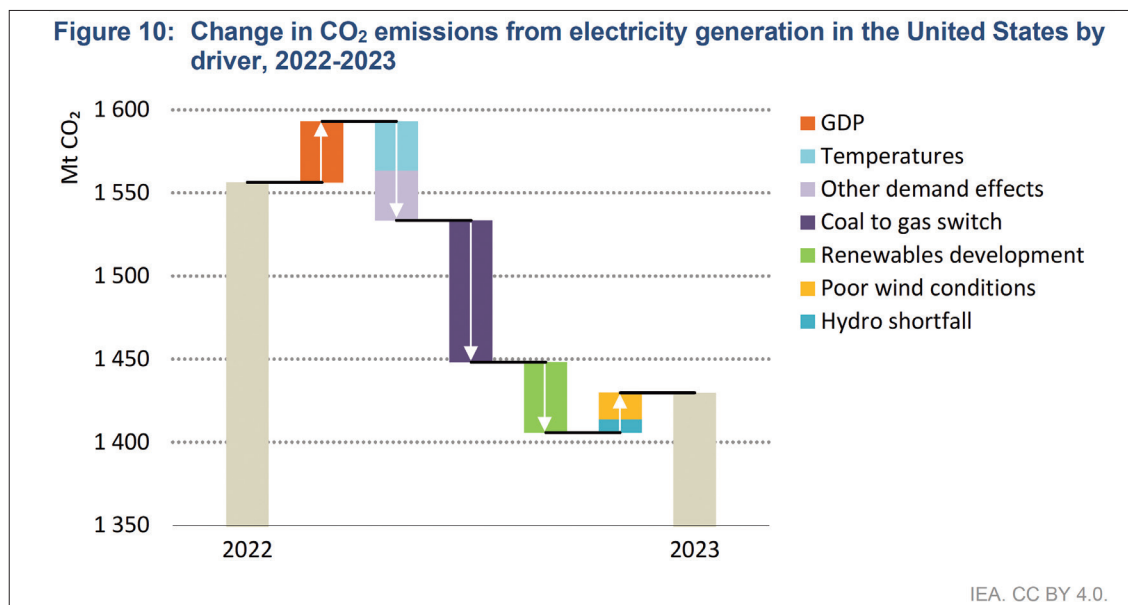
Coal-to-gas switching is also important to reduce carbon emissions. The switch has progressed mainly in the United States and China, which has helped curb carbon emissions over recent years. The power generation sector in the United States achieved about 120 Mt of decarbonization from 2022 to 2023, of which about 80 Mt came from coal-to-gas switching.

Exhibit 2: Carbon Dioxide Emission Reductions from Coal-to-Gas Switching³



3. IEA (2019), The Role of Gas in Today's Energy Transitions, IEA, Paris <https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions>, License: CC BY 4

Exhibit 3: Carbon Dioxide Emission Reductions in the Power Generation Sector in the United States by Driver⁴



Gas-fired power plants may be able to be converted to hydrogen power plants in the future. Demonstrations of power generation by co-firing gas and hydrogen are underway. In Japan, Mitsubishi Heavy Industries has succeeded in achieving 30 percent hydrogen co-firing.⁵ In Germany, 10 GW of “H₂ ready” gas-fired power plants are scheduled to be auctioned and converted to hydrogen power plants by 2040.⁶

Asian countries such as Viet Nam and the Philippines are planning to reduce the ratio of coal-fired power and increase the ratio of renewable energy and gas-fired power in the medium term. Developed countries have planned to gradually reduce the ratio of gas-fired power, but will continue to use gas-fired power generation capacity (alongside batteries and other energy storage technologies) to integrate variable renewable generation sources. Some European countries are reviewing their energy policies due to the energy crisis and increasing the ratio of gas-fired power compared with previous plans. In addition to Germany’s plan, the United Kingdom has announced increased support for the construction of new gas-fired power plants to maintain a safe and reliable energy supply during periods of insufficient renewable electricity output.⁷

4. IEA (2024), CO₂ Emissions in 2023, IEA, Paris <https://iea.blob.core.windows.net/assets/33e2badc-b839-4c18-84ce-f6387b3c008f/CO2Emissionsin2023.pdf>, License: CC BY 4

5. Mitsubishi Heavy Industries, 30 November 2023, <https://www.mhi.com/news/23113001.html>

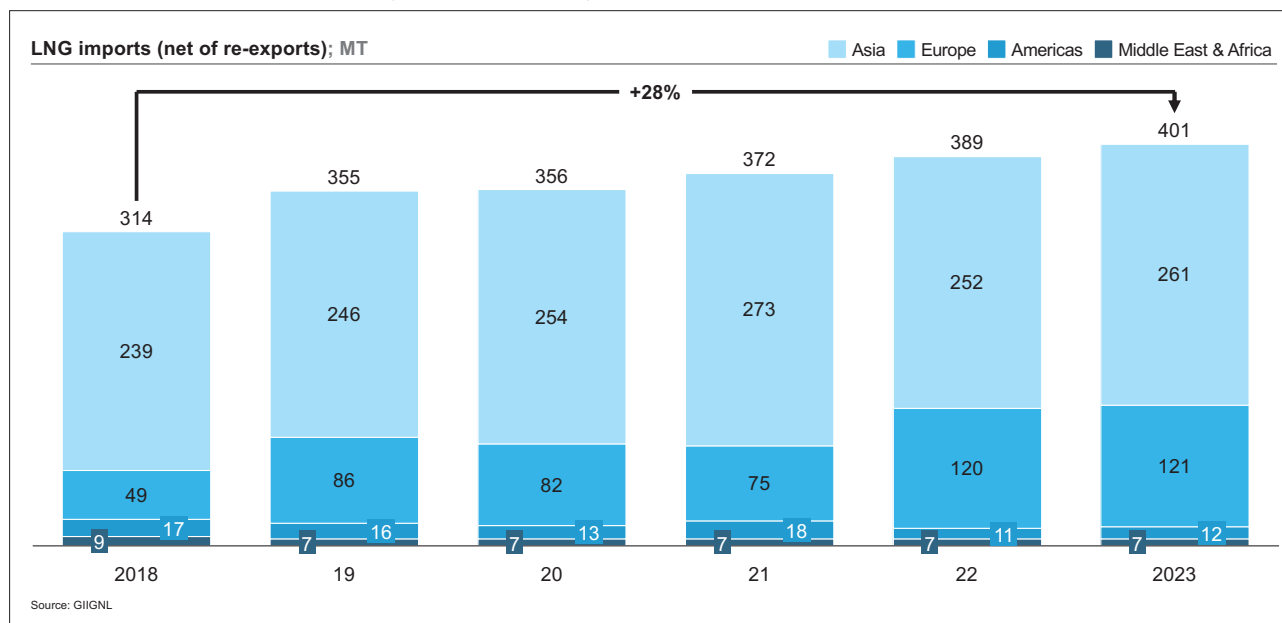
6. Federal Ministry for Economic Affairs and Climate Action, 5 February, 2024, <https://www.bmwi.de/Redaktion/EN/Pressemittailungen/2024/02/20240205-agreement-on-power-station-strategy.html>

7. Department for Energy Security & Net Zero, 12 March, 2024, <https://www.gov.uk/government/news/energy-secretary-takes-action-to-reinforce-uk-energy-supply>

LNG Demand Trends

Demand for LNG continues to grow, with global LNG imports and exports reaching 400 MT in 2023, according to GIIGNL data. Most of this strong LNG demand comes from Asia and Europe. Asian economies, including China and India, are expected to drive LNG demand in the future. LNG demand is expected to rise steadily until at least 2030, in line with the economic growth of emerging Asian countries.

Exhibit 4: Global LNG Imports and Exports⁸

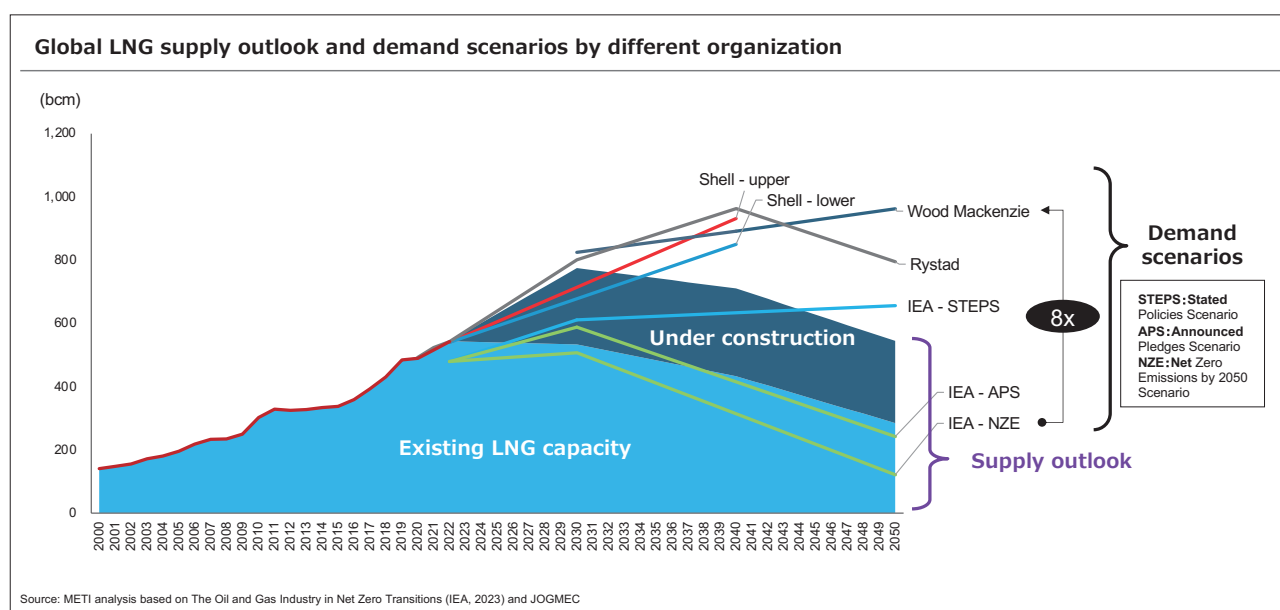


But there is increasing uncertainty about the future demand for LNG. Changes in demand for gas-fired power generation are expected to have a significant impact on LNG demand. Future LNG demand will be affected by the increase in power demand for generative AI and data centers, as well as the progress of electrification. Data center operators would need stable power source for their 24/7 operation. Gas-fired power generation, together with nuclear, hydro, and other power generation sources, is regarded as a strong candidate to power data centers due to its stability and low cost in the US. In fact, the amount of gas-fired power generation in the United States has been steadily on the rise, reaching 1,800 TWh in 2023, a record high.

8. International Group of Liquefied Natural Gas Importers, GIIGNL Annual Report 2024, June 3, 2024, <https://giignl.org/giignl-releases-2024-annual-report/>,

Against the backdrop of a changing energy environment, the public and private sectors have published various scenarios for future LNG demand. Among the demand scenarios, the IEA's World Energy Outlook (WEO), is particularly influential. The WEO includes three scenarios: the Stated Policies Scenario (STEPS), the Announced Pledges Scenario (APS), and the Net Zero Emissions by 2050 Scenario (NZE). The expected LNG supply gap differs across all three scenarios. In the STEPS, global LNG markets look amply supplied until 2040. In the APS, LNG demand peaks by 2030 and projects under construction today are sufficient to meet demand. In the NZE, demand can be met in aggregate with projects existing today. Other demand scenarios predict a different outlook. The most bullish one, published by Wood Mackenzie, is a base case forecast and it highlights the wide range of uncertainty in predicting future LNG demand. Understanding the various factors contributing to the divergence of LNG demand scenarios merits further in-depth analysis.⁹

Exhibit 5: LNG Supply and Demand Outlook by Scenario



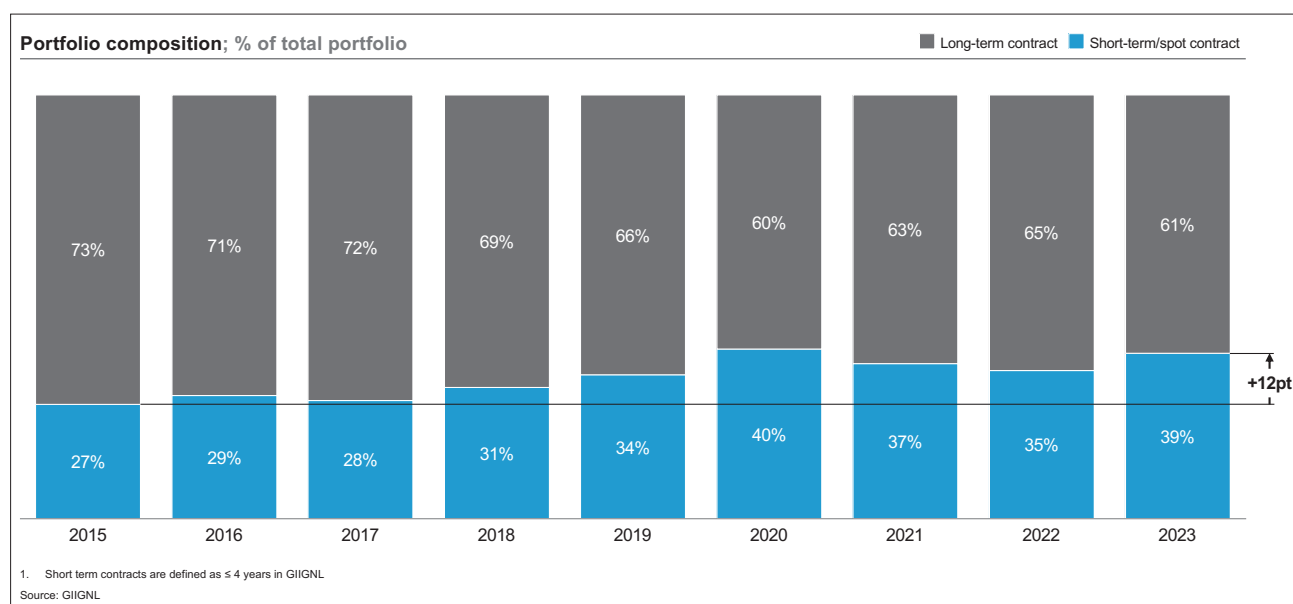
LNG Supply Trends

Although the supply-demand balance in the global LNG market remains relatively tight at the moment, the industry is experiencing the largest wave of LNG capacity expansion between 2024 and 2030, with approximately 270 bcm (200 MT) of new liquefaction capacity scheduled to enter service globally. More than 70% of this new capacity is expected to come from the United States and Qatar alone, which together accounted for the vast majority of final investment decisions in recent years.

9. IEA (2022), World Energy Outlook 2022, IEA, Paris <https://www.iea.org/reports/world-energy-outlook-2022>, License: CC BY 4.0

There are diverse views on future LNG demand, reflecting a high level of uncertainty. This should be considered when discussing supply security issues going forward. In high demand growth scenarios, such as Wood Mackenzie's, competition for procurement in the spot market would intensify, driving up spot prices. Securing stable LNG supplies through long-term contracts could be one way to ensure energy security. Exploration and Production (E&P) companies rely on long-term contracts when deciding whether to invest in LNG projects. To recoup their significant capital investments, E&P companies must sell LNG over an extended period, which requires locking in profits through long-term contracts before reaching final investment decision (FID). However, consumers tend to prefer short-term contracts and spot market procurement, which provide flexibility to adjust procurement volumes if demand declines. Although contract periods lengthened in 2021 and 2022 due to the turmoil in the spot market following the invasion of Ukraine, the overall trend points towards shorter contract durations. In 2023, the share of spot and short-term volumes was almost 40 percent of total LNG trade, a 12-percentage-point increase compared to 2015, according to GIIGNL.

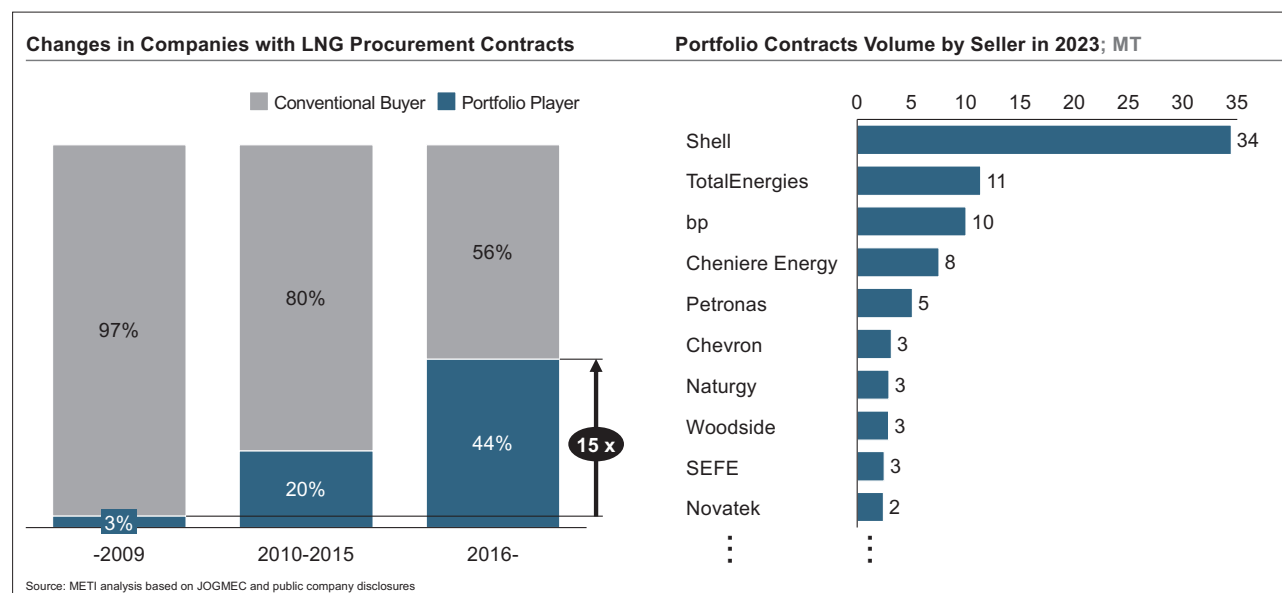
Exhibit 6: Long-Term vs. Short-Term LNG Contracts¹⁰



10. International Group of Liquefied Natural Gas Importers, GIIGNL Annual Report (2016-2024)

To respond to shorter contract periods, international oil companies (IOCs) such as Shell and BP are expanding their portfolio transactions to secure sales partners and facilitate project development.

Exhibit 7: The Role of LNG Portfolio Players¹¹



11. Japan Organization for Metals and Energy Security, LNG projects and contracts worldwide, 2024, https://oilgas-info.jogmec.go.jp/nglng_en/datahub/dh2024/1009974.html

Beyond shorter contract periods, concern over adequate project financing for the development of LNG projects is also increasing. Since LNG is a fossil fuel, it makes project financing more difficult to obtain in the context of net-zero objectives. The period of project financing for LNG terminals tends to be long due to large capital expenditures, which locks-in emissions over a long period. Financial institutions under pressure to reduce financed emissions may withdraw from project financing for LNG terminals to avoid the lock-in issues. In recent years, at least five prominent European and Asian banks announced that they will stop financing new upstream gas sectors. If other banks follow suit, the momentum for LNG project development may decline even more.

Exhibit 8: Announced Withdrawals from Oil and Gas Project Financing by Major Financial Institutions

Bank	Sustainability ambition	Stance on O&G project finance
 BNP PARIBAS	- Achieve net zero by 2050 - Set 2030 emission reduction targets for nine sectors 200 Bn EUR for transition to a low-carbon economy by 2025 - Set a target to increase low-carbon financing for energy production to 90% by 2030	- Suspension of investment and financing for new projects in the upstream sector from 2023 80% reduction in upstream oil investments by 2030, 30% reduction in upstream gas investments by 2030
 SOCIÉTÉ GÉNÉRALE	- Achieve net zero by 2050 - For the power/O&G sector (especially the upstream sector), we have set a 2030 emission reduction target consistent with the Paris Agreement. 300 Bn EUR between 2022 and 2025 to support the energy transition	- From 2024, we will stop investing in new projects in the upstream sector and gradually reduce services to players who only develop upstream sectors. 80% reduction in upstream financing by 2030 - Reduce GHG emissions (Scope 1, 2 and 3) in the sector by 70% by 2030
 ING	- Achieve net zero by 2050 - For the highest-emitting sectors, we have set 2030 emissions reduction targets consistent with the Paris Agreement. - Triple new financing for renewable energy by 2025	- Suspension of investment and financing for new projects in the upstream sector from 2022 - Stop financing drilling and production projects by 2040
 HSBC	- Achieve net zero by 2050 - Set 2030 emission reduction target that is consistent with NZE (net zero by 2050) for the power/O&G sector (especially in the upstream sector) - Sustainable finance of up to \$1 trillion by 2030 - Member of Asia Transition Finance Group	- Suspension of investment and financing for new projects in the upstream sector from 2022 - Reduce financed emissions by 34% by 2030
 ANZ	- Achieve net zero by 2050 - Set 2030 emission reduction target for the power and construction sectors in line with the Paris Agreement \$50 billion in loans by 2025 to support the transition to a low-carbon economy	- Abolition of investment and financing for new and expanded projects in the upstream sector from 2024 - Reduce financed emissions by 26% by 2030

Source: METI analysis based on publicly available information sources

Future investments in natural gas and LNG supply will need to carefully consider both the upside and the downside risks to energy demand. In recent years, project costs have been rising due to inflation and geographic constraints, which increases the need for project finance.

To secure financing for LNG project development, the definitions of financed emissions and transition finance should be updated. Natural gas and LNG can contribute to energy transitions by supporting the shift away from coal and the deployment of variable renewable energy sources. Therefore, the lack of appropriate financial support may hinder emissions reductions in the real economy. To prevent this, it is necessary for governments to clarify the role and necessity of LNG and determine the need for LNG financing in a coordinated manner. It is also important to make efforts to combat climate change through the decarbonization of entire LNG value chains, the reduction of methane emissions from upstream operations to downstream gas-fired power plants, and the development of low-carbon LNG products. These efforts can foster public recognition that LNG has a positive role to play in the energy transition, potentially dispelling lock-in concerns among financial institutions.

Besides conventional project finance, the development of non-traditional financing methods can be one of the solutions. New financing methods such as direct investment in projects by funds and issuance of project bonds have recently emerged. Although the number of projects and the scale of financing are limited, it may be necessary to develop and diversify such new financing methods to secure LNG financing.

E&P companies are operating in diverse ways, which may be indicative of new trends worth watching. International oil companies (IOCs) are increasing their portfolio. Middle Eastern players, such as ADNOC and Saudi Aramco, which have focused on oil development, are now also embarking on shale gas development. Both companies are involved in LNG projects in North America and have expressed a willingness to operate in the global LNG market. E&P companies need to consider investing in project development while considering these competitive trends, environment changes, and geopolitical risks.

