

LNG Strategy for the World

Chair's Summary for the LNG-PCC 2023
(LNG Producer-Consumer Conference)



July 18, 2023

TABLE OF CONTENTS

1. PREFACE7

| | | |
|-----|---|----|
| 1.1 | Background of the LNG Strategy for the World – Chair’s Summary for the LNG-PCC 2023 | 7 |
| 1.2 | Overview of the LNG Producer-Consumer Conference (LNG-PCC) | 8 |
| 1.3 | Overview of the IEA Task Force on Gas and Clean Fuels Market Monitoring and Supply Security (TFFS) | 8 |
| 1.4 | Summary of discussions on policy measures in the preconference workshops | 9 |
| 1.5 | Recommended next steps for the IEA Task Force on Gas and Clean Fuels Market Monitoring and Supply Security (TFFS) | 11 |

2. VOLUNTARY COMMITMENTS13

3. ANNEX32

| | | |
|-------|--------------------------------------|----|
| 3.1 | Role of gas | 32 |
| 3.2 | Recent trends | 34 |
| | European Union | 34 |
| | Emerging economies in Asia | 35 |
| 3.3 | LNG supply demand scenarios..... | 36 |
| 3.4 | Bottlenecks in the LNG business..... | 37 |
| 3.4.1 | Demand | 37 |
| 3.4.2 | Supply..... | 40 |
| 3.4.3 | Finance | 43 |
| 3.4.4 | Energy security | 44 |
| 3.4.5 | Decarbonization | 46 |
| 3.5 | Closing and disclaimer | 50 |

Table of Exhibits

| | |
|--|----|
| Exhibit 1: Proposed discussion topics until the next IEA Gas Ministerial Meeting | 11 |
| Exhibit 2: CO ₂ savings from coal-to-gas switching by region compared to 2010, MtCO ₂ | 32 |
| Exhibit 3: The Energy Trilemma | 34 |
| Exhibit 4: Main spot and forward natural gas prices, 2020-2023, USD/MBtu | 35 |
| Exhibit 5: LNG trade by scenario compared to existing and under-construction capacity, 2015-2050, in IEA's Outlooks for gas markets and investment | 36 |
| Exhibit 6: Annual upstream investment in natural gas supply in the IEA's <i>Gas Market Report, Q1-2022</i> | 37 |
| Exhibit 7: LNG offtake contracts signed by duration by year, Mtpa..... | 38 |
| Exhibit 8: LNG offtake contracting needs and examples by project type | 39 |
| Exhibit 9: End-of-contract FSRU capacity by year, Mtpa | 40 |
| Exhibit 10: Major gas flow to Gulf Coast in the US | 41 |
| Exhibit 11: Net zero commitments by major banks as of November 2022 | 43 |
| Exhibit 12: Experts' voices on financing LNG projects based on Japan's research | 44 |
| Exhibit 13: LNG supply sources for top 10 LNG importers in 2020 | 45 |
| Exhibit 14: List of pre-FID LNG projects based on public releases as of May 2023, Mtpa ... | 45 |
| Exhibit 15: Boil-off loss associated with long-term storage of LNG | 46 |
| Exhibit 16: IEA statements on methane emissions | 47 |
| Exhibit 17: Methane MMRV value chain (selected examples) | 48 |
| Exhibit 18: Hydrogen and ammonia economy | 49 |
| Exhibit 19: Preconference workshops and the LNG Producer-Consumer Conference | 50 |

Table of Tables

| | |
|--|----|
| Table 1: Examples of major Appalachian gas pipelines experiencing regulatory headwinds | 42 |
|--|----|

List of Abbreviations

| Abbreviation | Meaning |
|-----------------|--|
| APS | Announced Pledges Scenario |
| bcm | Billion cubic meters |
| BIL | Bipartisan Infrastructure Law |
| CAPEX | Capital expenditures |
| CCS | Carbon capture, and storage |
| CCUS | Carbon capture, utilization and storage |
| CGEP | Center on Global Energy Policy |
| CO ₂ | Carbon dioxide |
| COP | Conference of the Parties of the UNFCCC |
| DG ENER | Directorate-General for Energy |
| EC | European Commission |
| ECA | Export Credit Agency |
| EPA | Environmental Protection Agency |
| EU | European Union |
| EU-ETS | European Emissions Trading System |
| FECM | Fossil Energy and Carbon Management |
| FERC | Federal Energy Regulatory Commission |
| FID | Final investment decision |
| FSRU | Floating Storage and Regasification Unit |
| G7 | Group of Seven |
| GHG | Greenhouse gasses |
| GIIGNL | International Group of Liquefied Natural Gas Importers |
| H ₂ | Hydrogen |
| HoA | Heads of Agreement |
| IEA | International Energy Agency |
| IMEO | International Methane Emissions Observatory |
| IRA | Inflation Reduction Act |
| JBIC | Japan Bank for International Cooperation |
| JKM | Japan Korea Marker |
| JOGMEC | Japan Organization for Metals and Energy Security |
| LC | Low carbon |
| LDAR | Leak detection and repair |
| LiDAR | Light Detection and Ranging |
| LNG | Liquefied natural gas |
| LNG-PCC | LNG Producer-Consumer Conference |
| MBtu | Million British thermal units |

| Abbreviation | Meaning |
|-----------------|--|
| METI | Ministry of Economy, Trade and Industry |
| MIBGAS | Mercado Ibérico del Gas |
| MMRV | Measurement, monitoring, reporting and verification |
| Mt | Million tonnes |
| Mtpa | Million tonnes per annum |
| MVP | Mountain Valley Pipeline |
| NEXI | Nippon Export and Investment Insurance |
| NH ₃ | Ammonia |
| NJ | New Jersey |
| NJR | New Jersey Resources |
| NZBA | Net-Zero Banking Alliance |
| NZE | Net Zero Emissions by 2050 Scenario |
| OECD | The Organization for Economic Cooperation and Development |
| OGMP | The Oil & Gas Methane Partnership |
| PCC | Producer-Consumer Conference |
| RES | Renewable energy sources |
| ROK | Republic of Korea |
| SBL | Strategic Buffer LNG |
| SPA | Sales and Purchase Agreement |
| STEPS | Stated Policies Scenario |
| TFFS | Task Force on Gas and Clean Fuels Market Monitoring and Supply Security |
| TFG | Task Force on Gas Market Monitoring and Supply Security |
| TTF | Title Transfer Facility (virtual trading point for natural gas in the Netherlands) |
| US | United States |
| USD | United States dollar |
| WEO | World Energy Outlook |

Disclaimer

This document is published by the hosts of the LNG Producer-Consumer Conference 2023—Japan and the IEA Secretariat—as a contribution to the LNG-PCC. The findings, interpretations, and conclusions expressed herein are a result of a collaborative process in the preconference workshops facilitated and endorsed by the LNG-PCC hosts but whose results do not necessarily represent the views of the IEA, nor the entirety of its member countries, association countries, the LNG-PCC attendees from non-IEA countries, or other stakeholders.

Preface

LNG PCC 2023
LNG Producer-Consumer Conference



1. Preface

1.1 Background of the LNG Strategy for the World – Chair’s Summary for the LNG-PCC 2023

As the global focus on achieving net zero intensifies, the world is on a critical mission to push energy transitions and accelerate energy efficiency improvements and deployments of renewable energy and clean fuels such as low-carbon hydrogen and its derivatives such as ammonia. These continued efforts are essential to achieve the goals of the Paris Agreement and the decarbonization targets set by countries.

Natural gas/LNG has a role to play during the transition toward a net-zero future. If methane and other greenhouse gas (GHG) emissions are well managed, natural gas/LNG can be less polluting than other fossil fuels such as coal and has helped reduce power generation emissions in advanced economies throughout the last decade. Gas-fired power generation also complements the output fluctuations of renewable energy sources such as solar and wind. In the future, by combining with carbon capture, utilization and storage (CCUS), natural gas/LNG could continue to provide decarbonized power while also playing an important role as a raw material for low-carbon hydrogen and ammonia in the clean fuel value chain.

Last year’s global energy market disruptions, driven by Russia’s illegal war of aggression against Ukraine, put a spotlight on the LNG market like never before. After Russia’s war of aggression, European countries pursued energy supply chain independence from Russian gas by increasing LNG imports and building LNG import terminals, while emerging economies such as Bangladesh and Pakistan faced challenges in procuring LNG due to its soaring price.

At the 2022 LNG Producer-Consumer Conference (LNG-PCC), Dr. Fatih Birol, the Executive Director of the International Energy Agency (IEA), expressed concerns that the world was currently in the middle of a global energy crisis¹ that was more complex and could take longer time to resolve than the 1970s oil crisis. The global energy crisis is indeed still ongoing today, and the natural gas/LNG market conditions remain unpredictable.

Since 2022, key market participants and nations have been working together to mitigate the crisis and prevent future ones. They are looking ahead to short- and long-term energy security, while keenly aware of the need for energy transition to achieve the goals of the Paris Agreement and respective national climate targets. Such efforts may also lead to a shift in LNG’s role with an increased focus on its role in maintaining global energy security.

In May 2023, the G7 Hiroshima Leaders’ Communiqué discussed the important role of LNG under the current energy crisis and emphasized that the LNG supply could contribute to independence from Russian energy and energy security all over the world, including in developing countries:

“... It is necessary to accelerate the phase out of our dependency on Russian energy, including through energy savings and gas demand reduction, in a manner consistent with our Paris commitments, and address the global impact of Russia’s war on energy supplies, gas prices and inflation, and people’s lives, recognizing the primary need to accelerate the clean energy transition. In this context, we stress the important role that increased deliveries of LNG can play, and acknowledge that investment in the sector can be appropriate in response to the current crisis and to address potential gas market shortfalls provoked by the crisis. In the exceptional circumstance of accelerating the phase out of our dependency on Russian energy, publicly supported investment in the gas sector can be appropriate as a temporary response, subject to clearly defined national circumstances, if implemented in a manner consistent with our climate objectives without creating

¹ Ministry of Economy, Trade and Industry, 11th LNG Consumer-Producer Conference Held, September 30, 2022, https://www.meti.go.jp/english/press/2022/0930_001.html

lock-in effects, for example by ensuring that projects are integrated into national strategies for the development of low-carbon and renewable hydrogen.”²

These issues in the LNG market suggest that LNG can play an important, yet challenging, role in balancing global energy affordability, energy security, and environment and climate risks to ensure a just and orderly energy transition.

To address global security of supply risks and volatility of LNG markets on the path to decarbonization, there is an urgent need to engage IEA members and global partners on improved coordination between global LNG consumers and producers on LNG strategy based on three pillars:

- Security of supply early warning system
- Improved transparency of energy data
- Reducing methane emissions from LNG supply

The Chair encourages IEA members / EU to stand ready to enhance the information exchange regarding security of supply threats, explore cooperation on global flexibility options, and engage on further practices on treating methane along the gas value chain in line with OGMP 2.0 protocols.

At the same time, we highlight that Ministers agreed that energy savings and improved energy efficiency are the first fuel and accelerating the clean energy transition is vital in the IEA Ministerial meeting on Gas Markets and Supply Security in February 2023. They welcomed the successful response by the EU and others to the energy crisis in key areas of energy policy, from security of supply and gas storage to gas demand reduction and improved price transparency, faster deployment of renewables, and by targeted upgrades of energy infrastructure. This implies that structurally reducing gas demand to mitigate supply security risks is a fundamental measure for the world energy security.

1.2 Overview of the LNG Producer-Consumer Conference (LNG-PCC)

LNG-PCC is an international LNG conference hosted by Japan's Ministry of Economy, Trade and Industry (METI). The inaugural LNG-PCC was held in 2012 as the first international conference to bring together a wide range of stakeholders from both producing and consuming countries. Over the next decade, LNG-PCC served as a place to discuss issues concerning sound development of the LNG market, including supply stability and energy security.

The 2023 12th LNG-PCC is co-hosted by METI and the IEA Secretariat to further strengthen cooperation between international stakeholders in both public and private sectors, and to discuss how to ensure the stable supply of LNG to prevent a future energy crisis. This discussion complements ongoing efforts to accelerate a clean and sustainable energy transition in order to achieve global energy security and climate goals. Investment in clean energy and improvements in energy savings and energy efficiency remain a priority and need to be accelerated. To support a smooth transition, natural gas/LNG security remains critical; therefore, this discussion focuses on policy responses to ensure a just and orderly transition and to work toward cleaner natural gas/LNG.

1.3 Overview of the IEA Task Force on Gas and Clean Fuels Market Monitoring and Supply Security (TFFS)

IEA was established in 1974 as an autonomous inter-government organization within the OECD framework. It was created in response to the first oil crisis after a proposal from then-US Secretary of State Henry Kissinger to ensure the security of oil supplies through international cooperation.

² Ministry of Foreign Affairs of Japan, *G7 Hiroshima Leaders' Communiqué*, May 20, 2023, https://www.g7hiroshima.go.jp/documents/pdf/Leaders_Communique_01_en.pdf

The world is again facing an energy crisis with a strong need for international cooperation toward energy security, including a climate- and decarbonization-oriented focus on LNG and natural gas this time. The Task Force on Gas and Clean Fuels Market Monitoring and Supply Security (TFFS) was established last year to strengthen the resilience of natural gas systems by providing close monitoring and coordination on global, regional, and local gas markets and relevant policy developments as well as on linkages with other energy markets. The Task Force will advise on issues across the wide spectrum of the security of supply of gas, such as: (a) flexibility and diversification of gas supply, (b) resilience and integration of infrastructure networks and capacity, for gas storage, liquefaction, regasification, transportation, and distribution, and (c) demand-side flexibility and complementarity with other energies. In February 2023, Ministers from about 40 countries met for an IEA Ministerial meeting on Gas Markets and Supply Security, discussed security of gas and LNG, and issued the Joint Statement that included the message below:

*"Ministers note that this gas crisis has made it clear that clean energy transition and increasing stability in the global LNG market, specifically security of supply and price stability, is a common task for all gas producing and consuming countries in the world. Moving forward from this meeting, Ministers will continue the discussion concerning additional countries impacted by the global energy crisis. Future discussions will take into account longer-term perspectives and opportunities for dialogues between gas producing and consuming countries, with the objective to avoid repeating the current crisis."*³

1.4 Summary of discussions on policy measures in the preconference workshops

IEA and METI jointly hosted several preconference workshops in April, May, and June to better understand and create a shared perspective on potential bottlenecks that LNG faces and on potential policy responses to overcome the energy trilemma, which are detailed in the Annex of this document. Potential policy responses that were discussed include strengthening natural gas/LNG reserves, increasing global data transparency, reducing GHG emissions of natural gas and LNG through the GHG framework standardization, and supporting transition to renewable/low-carbon hydrogen/ammonia. These sessions also included discussions with LNG producers and consumers from non-IEA countries, such as QatarEnergy (Qatar), Summit Power International (Bangladesh), and AboitizPower (the Philippines), and perspectives from academia on the increased importance of energy security for a just and orderly energy transition.

The workshop discussions emphasized the necessity of international actions on natural gas/LNG. The potential areas of collaboration include but are not limited to global security of supply and flexibility/reserve cooperation, increased global data transparency, and GHG reduction.

For instance, early global exchange between producing and consuming countries was suggested as one of opportunities to strengthen security of supply. In addition, as an option for individual consuming countries, voluntary solutions for developing storage and/or non-domestic reserves that are feasible, economic, and suitable for particular applications can provide additional security. Several regions and countries shared their ongoing efforts related to natural gas/LNG reserves. For instance, the European Union introduced a storage regulation in June 2022 that required gas storage sites to be filled above 80% before winter 2022/2023 and above 90% in the following winters. In fact, last winter, the collaboration across EU Member States enabled 95% of storage capacity in Europe by November and "greatly helped strengthen the security of supply."⁴ However, not all regions have geological features suitable for gas storage, and LNG cannot be stored long-term due to boil off. As such, different approaches to maintaining a strategic reserve of natural gas/LNG exist. In December 2022, Japan announced the launch of a "Strategic Buffer LNG" from winter 2023/2024. Under

³ International Energy Agency, *Ministers from around 40 countries meets to discuss the current gas crisis and collaborative actions on global energy security and the clean energy transition*, Feb. 15, 2023, <https://www.iea.org/news/ministers-from-around-40-countries-meet-to-discuss-the-current-gas-crisis-and-collaborative-actions-on-global-energy-security-and-the-clean-energy-transition>

⁴ European Commission, *Report from the Commission to the European Parliament and the Council*, March 27, 2023, https://energy.ec.europa.eu/system/files/2023-03/COM_2023_182_1_EN_ACT_part1_v2.pdf

this framework, participating LNG importers secure an additional volume of LNG as a buffer, which the government could direct in emergencies to locations with the greatest need, such as smaller regional gas or power companies. Japan also shared its idea of obtaining equity stakes in overseas LNG projects through a public and private partnership as a form of overseas LNG “reserve,” rather than having domestic storage facilities. Academics suggested an LNG options contract, where importers have the right to buy a set volume of LNG in exchange for a premium, as an alternative storage option.

Several participants highlighted the potential for the IEA to enhance its role in the coordination of stockpiles beyond oil to gas and critical minerals. The increasing attention to the need for ensuring reserves of natural gas/LNG presents an opportunity to further discuss potential roles of IEA in natural gas/LNG security, learning from its experiences in oil stockholding systems and building on its in-depth energy markets knowledge and analysis. IEA member countries hold more than 60% of underground gas storage and LNG storage capacities. In one of the preceding workshops, the IEA presented an overview of the global state of gas storage and stressed that effective storage regulation can contribute to gas and energy supply security. IEA has sent out a questionnaire to member states to conduct further analysis.

Global data transparency of natural gas/LNG and broader energy systems was also discussed as a potential lever to strengthen natural gas/LNG supply security. Spain presented the evolution of its gas/LNG market and digital data platform (including infrastructure capacity, virtual LNG tank, spot gas price) as well as examples of strengthened collaboration with neighboring countries. In Spain, Enagás provides real-time information and oversees regulated third-party access to LNG/gas infrastructures and MIBGAS, a gas market operator, provides traded volumes and prices of gas and LNG. The US Department of Energy shared gas and LNG data from the Office of Fossil Energy and Carbon Management and the Energy Information Administration, such as historical prices, monthly Henry Hub spot price forecasts, and exported LNG volumes and prices. In the US, authorized LNG exporters are required to submit cargo-level information via a data form every month. The European Commission presented a non-paper on a proposal for increasing global transparency, which argued that it is the backbone of security of supply architecture (please see the Voluntary commitments section for details). The Commission shared an overview of the EU’s LNG infrastructure data and highlighted the implementation of the ACER LNG Benchmark, a new daily LNG price assessment for North-West and South Europe that was introduced in January 2023.

In addition, reduction of GHG emissions, particularly methane, was discussed as a key element for natural gas/LNG. While methane reduction levers are relatively cost effective, insufficient regulations and incentives as well as the lack of a standardized framework challenge methane reduction efforts. Several countries have shared their proposals to help tackle these. The US Department of Energy described its ongoing effort to develop a standard measurement, monitoring, reporting and verification (MMRV) framework for GHG emissions for natural gas. Australia’s Department of Industry, Science and Resources highlighted an opportunity to create a credible global method for estimating and reporting LNG emissions. The European Commission also shared its ideas for reduction of methane emissions from the LNG supply chain, such as creating methane emissions profiles of each jurisdiction/basin, LNG emissions profiles for physically delivered gas, and an assistance function to support methane measures.

The measures to respond to the energy crisis vary across regions/countries and their unique energy circumstances, such as demand outlook and renewable energy potential. Therefore, a “one-size-fits-all” standard approach is not feasible. As part of the LNG-PCC, voluntary commitments from participating countries were collected, featuring each country’s policies and efforts to minimize natural gas/LNG supply disruptions and achieve a just and orderly transition. These commitments include efforts ranging from strengthening natural gas/LNG reserves to implementing GHG emissions reduction measures to abate emissions in the LNG value chain.

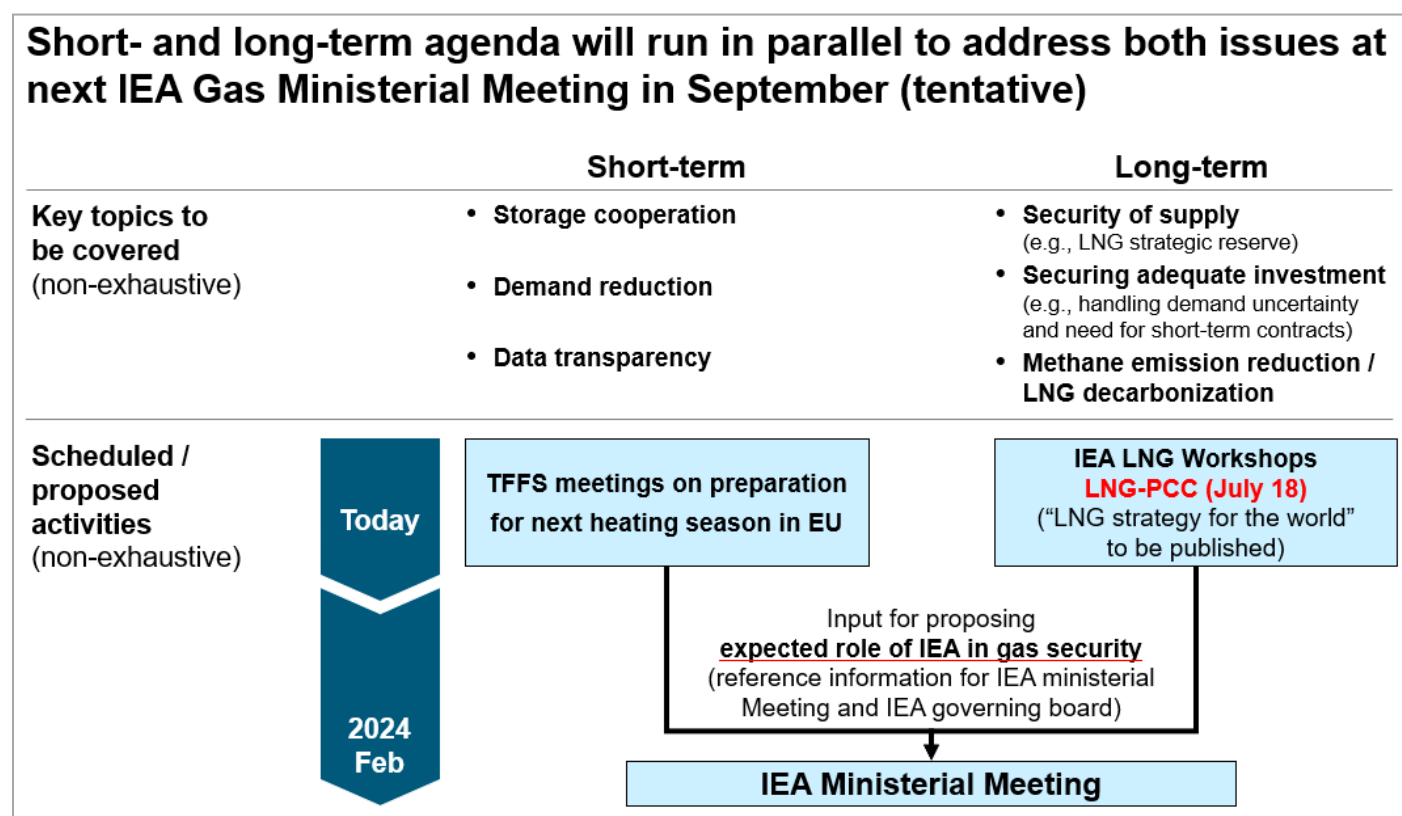
The International Energy Agency continues to closely monitor the evolution of global gas markets through its Monthly Gas Bulletin and Quarterly Gas Reports. The Global Gas Security Report 2023 edition was published on 18 July and launched at the LNG-PCC.

The *LNG Strategy for the World – Chair’s Summary for the LNG-PCC 2023* serves as a summary document by the chairmen of the LNG-PCC—Japan and the IEA Secretariat—on the discussions within the preceding workshops and those among IEA members and other LNG-PCC participating countries on gas supply security. The *LNG Strategy for the World* is not an agreement communiqué of the IEA and does not necessarily represent the views of the IEA, nor the entirety of its member countries, association countries, the LNG-PCC attendees from non-IEA countries, or other stakeholders. To support overcoming the short-term energy crisis and work toward long-term security and a just and orderly transition, Japan and the IEA Secretariat hope that the LNG-PCC and the *LNG Strategy for the World* encourage the continued discussion of policy response measures before the next IEA Ministerial meeting.

1.5 Recommended next steps for the IEA Task Force on Gas and Clean Fuels Market Monitoring and Supply Security (TFFS)

In a series of TFFS meetings and workshops, GHG reduction and natural gas/LNG reserves emerged as two key focus areas for ensuring the long-term supply security of natural gas/LNG. Participants are paying an increasing level of attention to how emissions in the LNG value chain can be abated. Building on the efforts shared during the workshops by the US and Australia on their GHG reduction efforts, further discussions on GHG reduction to reduce the emissions footprint of natural gas/LNG are critical. The IEA also acknowledges the recommendations from some member countries seeking IEA to continue its role in providing recommendations based on the analyses of the state of natural gas/LNG reserves and in facilitating collaboration and coordination among IEA Members and dialogue between natural gas producer, consumer, and transit countries. The IEA calls on the TFFS members to continue the dialogue toward the IEA Ministerial in February 2024.

Exhibit 1: Proposed discussion topics until the next IEA Gas Ministerial Meeting



Voluntary commitments

LNG PCC 2023

LNG Producer-Consumer Conference



2. Voluntary commitments

As part of the *LNG Strategy for the World – Chair's Summary for the LNG-PCC 2023*, Japan, as the LNG Producer-Consumer Conference chairman, requested participants to share existing policies and voluntary commitments for a cleaner LNG value chain to achieve net-zero and increase LNG/natural gas security.

Voluntary commitments

Australia



Australia is committed to reaching our net zero emissions target by 2050. Natural gas, will continue to play a role while Australia transitions to net zero, while also continuing to underwrite energy security for our key trading partners.

The Australian Government has legislated landmark climate reforms to reach our net zero commitments. Our Safeguard Mechanism reforms ensure future gas investment occurs in line with the trajectory to net zero. The Australian Government has also committed to provide regulatory and administrative certainty for CCS projects in the resources industry, as well as broader industrial use cases.

Australia is developing a Future Gas Strategy that will identify barriers and risks to long-term gas supply security for Australia's domestic and international markets. These risks will include investment, infrastructure and social licence risk as well as shifts in gas demand over the medium and long-term. The strategy will explore options to ensure gas supply through streamlined regulatory arrangements, better utilisation of existing fields, electrification, reducing demand and alternatives to natural gas.

Australia is engaging with the IEA TFFS on the measurement and reporting of LNG emissions. There is an opportunity to create a global method for estimating and reporting LNG emissions that would allow buyers to discriminate between cargoes on an emissions basis.

Voluntary commitments

Canada



Canada is committed to the energy transition and net-zero emissions by 2050, which is enshrined in the June 2021 Canadian Net-Zero Emissions Accountability Act. The Government of the Province of British Columbia, where most new Canadian LNG projects will be located, has also committed to being net-zero by 2050.

Forthcoming Canadian LNG projects will have among the cleanest LNG, with world-leading emissions performance. Our government is open to LNG projects that displace higher-emitting fuels, are consistent with Canada's climate commitments, have industry-leading, best-in-class emissions performance, and align as possible with a transition to lower carbon fuels, such as ammonia or hydrogen.

From 2011-2021, emissions from natural gas production and processing in Canada declined by 24%, despite natural gas production volumes increasing by 11%, which indicates a significant improvement in natural gas sector emissions intensity.

Key to these efforts were improved operational efficiencies, enhanced leak detection and repair requirements, and successful government regulations to reduce methane emissions, as well as the introduction of a price on carbon emissions.

Canada was the first country to support the Global Methane Pledge to reduce global methane emissions by 30% from 2020-2030, and Canada's natural gas sector has already surpassed this target. To reduce methane emissions further, Canada is working on enhanced methane regulations to achieve at least a 75% reduction in oil and gas sector emissions by 2030 below 2012 levels.

Canada is continuing to increase the stringency of its carbon pollution pricing regime, while working toward a cap on oil and gas sector emissions. Moreover, Canada is developing guidance to support "best-in-class" GHG emissions performance for oil and gas projects throughout their lifetime, as well as strengthened Clean Electricity Regulations to achieve a net-zero electricity grid by 2035 that will support natural gas producers' access to cleaner power for their operations.

In addition, the 2019 Impact Assessment Act included statutory timelines to ensure efficient federal regulatory proceedings for projects. The Act also requires projects to undergo a Strategic Assessment of Climate Change, requiring proponents to quantify project GHG emissions and to outline a credible plan to reach net-zero by 2050, for facilities expected to be in operation post-2050.

Voluntary commitments

Canada - Alberta



The global energy system is undergoing immense change, as countries turn towards cleaner energy sources to lower emission and improve air quality. Canada's natural gas industry is doing its part to make a difference in global emissions reductions.

Canada is among the top global natural gas producers. Two-thirds of Canadian production is from Alberta and we can grow our supply to meet the global LNG needs.

Alberta remains an advocate of Canadian LNG projects that will support global energy security and emissions reduction goals. Canada will soon have its first global LNG export facility and Alberta is advocating for additional LNG projects in Canada.

We continue to collaborate with other governments, regulators, and industry to streamline project approvals, improve pipeline access and build infrastructure to ship natural gas to international markets.

More Canadian LNG is good news for global energy security and emissions reduction.

Our province is proud to be one of the most responsible producers of oil and gas globally. Alberta was the first government in Canada to set a methane emissions reduction target, and we are on track to meet, and surpass, our goal of reducing methane emissions from the oil and gas sector by 45 per cent below 2014 levels in 2025.

That, coupled with lower carbon intensity of Canadian LNG projects, will position Canada to be the supplier of choice for our global allies. Our unparalleled low cost energy resources, commitment to emissions reduction and historical connections with Japan position us to be a key contributor to Japan's efforts to diversify its LNG supply.

Alberta will continue to play a leadership role in expanding and advocating for greater market access for the province's responsible, affordable, and secure energy resources.

- Alberta Energy and Minerals, Government of Alberta, Canada

Voluntary commitments

Czech Republic



Considering that the Czech Republic is a landlocked country it has limited options regarding LNG. The Czech Republic has switched from Russian natural gas imports to significant share of LNG imports over the last year (no Russian gas will flow to the gas market of the Czech Republic in 2023.). ČEZ Group in cooperation with the state acquired a share of 3 bcm/year for a period of 5 years at the LNG terminal in Eemshaven, the Netherlands which further strengthened gas security for upcoming years. The Czech Republic also implemented "Use-it-or-lose-it" principle on the use of gas storage capacity into national legislation and established state gas reserves to ensure enough gas for protected consumers during emergencies. In accordance with the European regulation on demand reduction it reduced its gas consumption by 20% in 2022 (compared to 2021). Since the start of the 2023 cca 0,5 bcm of gas was saved. As a result of these policies and measures, domestic gas storage tanks were filled to the level of 100% of their maximum capacity in 2022 and to the level of 80% currently (we assume that they will be completely full again by the winter season). The Czech Republic is also currently developing a new National Energy Strategy, while at the same time, like other EU Member States, it is working on updating its National Energy Climate Plan.

Voluntary commitments

France



Since 2021, restrictions on natural gas exports decided unilaterally by the Russian government have had a major impact on international gas markets.

In France, a reduction in natural gas consumption and an increase in imports of liquefied natural gas (LNG) was implemented to offset the reduction in Russian gas imports.

In recent months, the French authorities have been careful in ensuring that natural gas suppliers have the needed LNG import capacities to supply their customers. The use of existing LNG terminals has been optimised and a floating terminal is due to be commissioned in France before the coming winter.

The smooth functioning of the global LNG market and the availability of LNG over the coming years are particularly important and the French government welcomes the conference, bringing together producers and consumers, organised on 18 July by the Japanese Ministry of Economy, Trade and Industry in cooperation with the International Energy Agency. In particular, the French government will support international efforts to facilitate and increase the exchange of information between players in the global gas market, which is extremely useful in times of tension.

The French government is also committed to continuing its efforts to forecast and contain national natural gas consumption over the coming winter and in the long term.

In the short term, an energy savings plan aimed at a voluntarily reduction of French energy consumption by 10% over two years is being implemented. Last-resort measures have also been put in place in case of periods of extreme tension.

For the longer term, measures have been taken to accelerate the deployment of renewable and low-carbon energies including nuclear, further improve energy efficiency and reduce imports of liquefied natural gas. A new multiannual energy plan will shortly set out the outlook for national natural gas consumption over the next 10 years.

Lastly, the French government stresses the need to combat climate change in line with the commitments made in the Paris Agreement. It will support European and international initiatives aimed at better measuring and reducing methane emissions associated with natural gas production and supply.

Voluntary commitments

European Commission



The European Commission sees a need for better information sharing and coordination to stabilise global LNG markets on the path towards decarbonisation. The EU wants to engage with its global partners on transparency and exchange of information regarding security of supply threats and incidents, infrastructure usage and availability. Finally, the EU stands ready to investigate cooperation frameworks on global flexibility in the gas and LNG sector for the purpose of security of supply and addressing volatility.

The global LNG approach should be based on three pillars:

1. Security of supply early warning system
2. Improved transparency of energy data
3. Reducing methane emissions from LNG supply

Regarding security, the EU will propose to set up a global early warning system and SoS cooperation framework. The EU will be building on its decade-long expertise in developing resilient energy security policy based on cooperation between regions and countries to pre-empt and eventually tackle energy crisis. The EU security framework, strengthened during the 2022 supply shock, is supported by a pan-EU gas storage policy and the gas demand aggregation tool, AggregateEU.

Regarding transparency, the EU sees the transparency of energy markets as the backbone of security of supply and therefore believes that it should be part of the future global LNG architecture. To this end, there is a need to enhance exchange of critical data of relevance for energy security across the consuming and producing regions. Today, the EU is a world leader in providing comprehensive information on its electricity and gas systems. Since 2022, the EU has further improved the transparency with respect to LNG terminals, price indices and gas storages with European Transparency Platforms and ACER LNG benchmark.

From a climate perspective, the EU spearheaded international cooperation on Monitoring Reporting and Verification, abatement and mitigation of methane emissions in the energy sector. Where the EU would like to engage with its global partners is further promotion of best practices on treating methane along the gas value chain in line with OGMP2.0 protocols, and enhancing transparency through IMEO.

IEA Task Force on Gas Markets & Clean Fuels Market

European Commission's input to the global LNG strategy
& LNG conference in Japan on 18 July

2023-06-23

I. GLOBAL LNG STRATEGY TOWARDS 2050

The European Commission ('EC') sees a need for enhanced global coordination to stabilise the global LNG markets on the path towards decarbonisation. This is the **Commission's contributions** to the discussion and final report on the "LNG Strategy for the World" ('*LNG Strategy*') to be advanced at the LNG producer-consumer conference on 18 July. This work is also part of the IEA Task Force on gas, security of supply and clean fuels ('*IEA TFG*').

The Commission commitments and ideas build on EU's leadership on energy policies, in particular on security of supply, transparency and methane emissions policies. It also reflects the experiences and policy advancements since the 2022 energy crisis. Non-action at the global level could contribute to volatility and uncertainty around security of supply and adversely impact countries active on LNG markets. Also, it would be a missed opportunity for global methane work and developing a path for cleaner LNG supply chain.

A global LNG strategy requires international action to deliver across the following three pillars:

1. Security of supply cooperation between consumers and producers.
2. Improved transparency of key energy data.
3. Reducing methane emissions.

II. EC/DG ENER'S CONTRIBUTIONS TO LNG STRATEGY

The below proposal reflects the EC's commitments to build a global LNG framework. The EU's existing policies contributing to more secure and transparent markets have been transmitted separately on 16 June.

EU proposals for LNG conference on 18 July and its final report

| Action/concept | Objective(s) | Tools / stake holders |
|---|---|--|
| GLOBAL SECURITY OF SUPPLY | | |
| Early Warning System (for global Security of Supply) Create a system of security of supply information exchange between consuming and producing regions. Based on EU's experience with EU SoS Regulation 2017/1938. | <ul style="list-style-type: none">- To have communication channels directly between regions/countries and their competent authorities.- To inform about disruptions or imminent risks of disruption of major supply/ export facility / sudden demand increase. | Implementation in several steps, steps could be merged, for example: <ul style="list-style-type: none">- Step 1: Biggest consumers- Step 2: Consumers & key producers- Step 3: IEA Members- Step 4: Involve Non-IEA Members Need to agree a "trigger" for an early warning & level of coordination. |
| Global flexibility cooperation (coordination on storage and/or other sources of flexibility) | <ul style="list-style-type: none">- Explore how to address global volatility and security of supply through various forms of flexibility tools.- For example, storage is an important source of flexibility and SoS. Details would require expert work between EU and 3rd country/ies to see how some form of coordination may increase gas | <ul style="list-style-type: none">- Step 1: identify global and/or regional sources of flexibility- Step 2: have regions/countries commit their pledges into the reserves- Step 3: Create a mechanism to use it, activate it For example, countries could buy "ticketing service" to store gas in partners' storage & swap with LNG deliveries. |

| | | |
|---|--|---|
| | reserve globally to be used in case of shocks or significant volatility. | |
| Improved global LNG information sharing | <ul style="list-style-type: none"> - Addressing volatility and SoS between major consumption centers - Eventually, exploring protocols for coordination of LNG cargoes deliveries between regions in SoS situation (could be combined with storage flexibility). | <p>More assessment needed on substance and who would coordinate:</p> <ul style="list-style-type: none"> - Step 1: Introduce bilateral info exchange between central purchasing agencies. - Step 2: explore mechanisms to support re-routing of LNG cargos (e.g. could be contractual, market based). - Option 3: explore a broader role of AggregateEU tool |
| GLOBAL TRANSPARENCY OF LNG | | |
| Improve transparency <ul style="list-style-type: none"> - storage - prices - regas capacities - export/import RES and low carbon gases <p>There are big disparities in information on energy between regions. This contributes to uncertainty and speculation.</p> | <ul style="list-style-type: none"> - Sharing storage (underground & floating) & LNG data and plans from Asia - Sharing LNG send-out/regas capacities of IEA members - Data on planned investment on gas-related infrastructure (fields, liquefaction & regas capacity) - Possibilities for export/import of RES & low-carbon gases | <p>EC to share its top of the class transparency & recent improvements through Gas Infrastructure Europe, and support other Regions to reach similar level of transparency:</p> <ol style="list-style-type: none"> 1) Flexibility/security of supply measures /storage levels & needs e.g. EU-Asia 2) Collation of data & sharing with participants (IEA) & non-IEA 3) Info exchange on RES/LC LNG infra |
| REDUCTION OF METHANE EMISSIONS FROM LNG SUPPLY CHAIN | | |
| Create methane emissions profile of each jurisdiction and/or basin based on best MMRV practices | Incentivise emissions control in the entire supply chain, and not just the infrastructure used in international trade | For these three measures, it is proposed to collaborate with IMEO /IEA/OGMP World Bank/other |
| Create LNG emissions profiles matching the attributes of physically delivered gas with claimed cargo / company profile | Assure best practice on LNG shipping and create protocols for MMRV in LNG shipping | |
| Create an assistance function to support domestic abatement measures and for accelerated methane collection and marketisation | Reduce need for greenfield hydrocarbon investments (IEA 260 bcma figure of gas wasted through flaring, venting, etc) | |

Voluntary commitments

Germany



Germany has undergone tremendous efforts in the course of the 2022 energy and gas crisis to rid itself from its dependence on the imports of Russian natural gas. It has jump-started the set-up of temporary LNG infrastructure to be converted to green hydrogen use, re-organized its natural gas import flows from East to West, introduced several gas savings measures, has ramped-up its crisis management and crisis preparedness efforts and is fostering structural measures for significantly reducing the demand of natural gas. LNG imported via facilities on its North and Baltic Sea coast serves a broad European market and strengthens the resilience of a closely interlinked European gas market.

As part of an elaborate European Union security of gas supply regime, Germany stays committed to EU security of gas supply regulations and has actively contributed in shaping the 2022 emergency gas regulations in order to mitigate the risks imposed by a changing supply setting.

In order to increase resilience in its energy supply in the long-term, Germany has stepped-up its efforts to decarbonize, increasing the speed of renewable energy production with the aim of reaching 80% renewable energy generation by 2030, and has a clear view on establishing a green hydrogen economy.

Germany supports international efforts on reducing greenhouse gases and in particular methane emissions along the LNG supply chain. In this context, Germany is part of the jointly U.S. and EU organized efforts to strengthen monitoring, measuring, reporting and verification frameworks for the detection of methane emissions and supports the Global Methane Pledge. Furthermore, Germany supports EU efforts in setting up respective regulations on reducing methane emissions.

Germany stays fully committed to the Paris agreement and the 1.5° warming limit and has set itself the goal to achieve climate neutrality until the year 2045.

Voluntary commitments

Italy



The past two gas years presented several difficult challenges to the Italian gas system. The uncontrolled price volatility, started in 2021, and the geopolitical instability due to the Russian invasion of Ukraine in February 2022 urged the Italian Government to put in place several actions, in line with the other EU Member States and with the indications from the European Commission.

Italy tackled the issues of price volatility and dependence on Russian gas supporting new rules for gas system and market management at EU and national level, increasing its LNG import capacity, reducing its gas consumption particularly of household and industrial customers.

Looking to the future with less short term contingencies, Italy envisage the need for a wider coordination on global scale, keeping the engagement on green transition and decarbonisation.

To this end, Italy shares the European Commission need for better information sharing and coordination to stabilise global LNG markets on the path towards decarbonisation, the will to engage with its global partners on transparency and exchange of information regarding security of supply threats and incidents, infrastructure usage and availability, the need to investigate cooperation frameworks on global flexibility in the gas and LNG sector for the purpose of security of supply and addressing volatility.

Italy then supports the three pillars of the global LNG approach proposed by the EU Commission, and its commitment on an “early warning system” to ensure prevention of possible global LNG crisis through information exchange and transparency of energy data, reducing in the meantime methane emissions from the LNG sector.

Voluntary commitments

Japan



Based on the workshop discussions, Japan has taken the lead on reducing GHG emissions in the LNG value chain and natural gas/LNG reserves to enhance energy security. Japan commits to contributing to the discussion on the potential roles for IEA in natural gas/LNG by leading efforts on reducing emissions of the LNG value chain and exploring different forms of reserves for natural gas/LNG, which are harder to store than crude oil. Japan also will focus on commitments under the Economic Security Promotion Act related to security of supply of natural gas/LNG. Furthermore, Japan aspires to learn from other countries' initiatives and incorporate that knowledge into its own actions.

Clean LNG: Japan supports reduction of GHG emissions throughout the LNG value chain, particularly methane emissions. Japan is fully committed to support the Coalition for LNG Emission Abatement toward Net-zero (CLEAN), a methane reduction effort led by Japan's public institution Japan Organization for Metals and Energy Security (JOGMEC) and private sector LNG buyers. JOGMEC will assist by providing an information platform of methane reduction targets and initiatives. Japan also backs international initiatives on GHG emissions, such as the Global Methane Pledge, the US/EU effort to develop an international framework for monitoring, measuring, reporting, and verification of GHG emissions of natural gas, and Australia's efforts to work with the IEA on developing technical guidance for measurement of LNG supply chain emissions.

Energy security: Japan views energy security as a critical topic in accordance with the G7 Hiroshima Leaders' Communiqué and plans to focus on increasing security of supply and enhancing liquidity of LNG. Japan follows the G7 Elmau Leader's Communiqué in consideration for its public support for LNG.

- **Increasing security of supply:** Japan will utilize the Strategic Buffer LNG (SBL) framework in response to an emergency and works with other LNG buyers in Asia for collaboration on LNG sourcing, including seasonality matching and emergency collaboration. Japan Bank for International Cooperation (JBIC) provides financial support for LNG supply projects for the energy security and pragmatic energy transition.
- **Enhancing liquidity of LNG:** Japan supports initiatives to increase the liquidity of the LNG market as part of the efforts to increase energy security. Nippon Export and Investment Insurance (NEXI) provides funding support for LNG trading and for LNG procurement by Japanese companies. Japan recognizes past global efforts to remove the destination clause in LNG and fully supports increased destination flexibility for LNG. Japan will continue to lead the LNG market liquidity development as a key buyer of LNG.

Voluntary commitments

The Netherlands



1. LNG is a globally important transition fuel for the short and medium term, especially insofar as energy-dependent countries/regions have not yet achieved near or full sustainability of their energy consumption.
 - In this respect, if we want to reach the Paris climate goals, the use of fossil fuels especially those with high CO₂-footprint should be reduced as soon as possible, and more efforts are required to rapidly increase the pace of development of sustainable, clean, energy production, worldwide.
2. For this role of 'transition fuel' to work efficiently and effectively, coordination of the balance of LNG supply and demand is an important factor in the business model for new and existing LNG installations (both on the production and on the import side), given the large-scale investments involved. This calls upon commitments of parties to find a balance between short/medium and longer term relations and associated contracts. Optimization of the various interests to support a well-functioning LNG-market is needed that can reliably guarantee that required volumes can be delivered, at reasonable costs, over the transition period.
 - In this respect, The Netherlands' support the initiative for the Joint Gas Purchasing Mechanism as adopted in December 2022 by the European Union. It is noted that this joint purchasing mechanism is open to participation from companies from Energy Community Contracting Parties. Other economic regions could follow this example, suited to their demands and requirements. We also support the 'Global Early Warning between major consumers and producers' as proposed by IEA and the European Commission in order to timely signal disruption in major supply sources, or sudden demand increase.
3. All parties involved in the 'LNG value chain' must in time prepare both existing and new LNG installations to support the transition to sustainable energy carriers, such as hydrogen and/or ammonia.
 - In this respect, The Netherlands' would call upon all parties to strengthen international cooperation and intensify work on this principle of 'Hydrogen-readiness' of the LNG-infrastructure in (far) more detail. And to prepare technical solutions and operational processes for each individual installation, either existing or new, to ensure this transition to renewable energy carriers will succeed. All LNG-producing countries are asked to explore options to produce these energy carriers for the benefit of all energy users in this world.

Voluntary commitments

Norway



Norway is a major gas supplier to Europe. Most of the gas from the Norwegian Continental Shelf is transported in pipelines. The exception is the LNG from the Barents Sea. The well stream from the Snøhvit field offshore is transported in a pipeline for processing to LNG at an onshore facility, and is from there shipped to the markets. During normal production, the Hammerfest LNG plant delivers around 6.5 bcm/year. CO₂ is separated from the wellstream at the LNG-plant and returned to the Snøhvit field by pipeline for injection and permanent storage. Approximately 700,000 tonnes of CO are separated and stored each year.

The CO₂-emissions from Hammerfest LNG plant is around 1 million tonnes per year. Around 90 percent of the CO₂-emissions comes from gas turbine generators, while other emissions mainly come from flaring. Flaring of natural gas on the Norwegian Continental Shelf is only permitted when necessary for safety reasons. Permits for flaring are issued by the Ministry of Petroleum and Energy.

The petroleum sector in Norway is subject to regulations in form of the European Emissions Trading System (EU ETS) and a CO₂-tax. The combination of the CO₂-tax and EU ETS means that the cost of emissions in the Norwegian petroleum sector is significantly higher than in other countries with petroleum activities. All CO₂-emissions at the Hammerfest LNG facility are subject to the EU ETS and CO₂-tax. This gives the partners in the Snøhvit field and Hammerfest LNG strong incentives to reduce CO₂-emissions from the production.

On average, emissions per unit produced on the Norwegian Continental Shelf are already low, and our aim is to further decrease the emissions from Norwegian oil and gas production. The existing Norwegian policies are important contributions towards cleaner LNG value chains and achieving a low emission society by 2050.

Voluntary commitments

Poland



Poland is strongly committed to maintaining a high level of gas supply security. Consistent strategy based on long-term planned development of gas infrastructure coupled with reasonable contracting approach by Polish companies (large portfolio of long-term LNG contracts with multiple reliable partners, as well as competences for ordering frequent spot deliveries) prepared country for energy crisis and allowed Poland to become completely independent from Russian supplies. Currently Poland takes efforts to limit the previously expected consumption increase of natural gas. Nevertheless, the upcoming decades will further require securing supplies to the customers in a closely synchronized way with energy transition. Thus, Poland will continue to diversify sources, directions and routes of supplies. In case of LNG, existing regasification terminal in Świnoujście is in final stage of expansion. After completion, its capacity will reach 8,3 bcm/year. Additionally, second LNG terminal (FSRU) with minimum capacity of 6,1 bcm/year, is planned to be located in Gdańsk not later than in 2027.

At the same time Poland is committed to pursue efforts to further develop renewables based on wind and solar capacities, as well as by promoting the development of RES which are independent from atmospheric conditions i.e. using the energy of water, biomass, biogas or geothermal energy. Further actions will be taken to replace the previously expected demand for natural gas with decarbonized gases.

Voluntary commitments

Qatar - QatarEnergy



We continue to take concrete steps across the entire LNG value chain to provide the world with the cleanest available hydrocarbon source of energy.

By 2029, about 40% of all new global LNG supplies will be provided by QatarEnergy projects, which will achieve significant reductions in GHG gas emissions through carbon capture and sequestration and the use of solar energy.

We aim to reduce the overall carbon intensity of our new projects by about 30% compared to previous generation designs.

These investments are part of our commitment to continue to be a reliable global supplier of cleaner energy, and help our partners to deal with the trilemma of energy security, affordability, and sustainability.

We reaffirm our determination to work with our buyers and partners to realize the full potential of LNG as a vital contributor to a realistic and responsible energy transition.

We support a realistic and resolute energy transition, starting with a solid integration of natural gas in the energy mix of today and tomorrow.

We strongly believe that Gas will continue to play a critical role as a safe and reliable base load energy source in the energy mix for most nations for decades to come and well beyond 2050.

The world needs a fair, credible and effective transition with a realistic and stable path, which wisely balances the needs of the human society and environmental protection. It should not continue to only focus on the needs of the rich and well-developed countries, but must prioritize the needs of developing countries, with each country having its own, unique transition path.

Voluntary commitments

The Republic of Korea



The Republic of Korea places a high priority on maintaining LNG security as a key aspect of its energy policy amidst ongoing global uncertainty. To ensure a reliable supply of LNG, the ROK regularly monitors the global gas market outlook, diversifies its sources of LNG procurement and implements LNG stockpile management measures. Furthermore, the ROK acknowledges the crucial role of international collaboration in addressing LNG supply instability and price volatility. The ROK also recognizes the importance of a cleaner LNG value chain, which will contribute to achieving net-zero while ensuring the security of LNG supply. Against this backdrop, the ROK reiterates its commitment to the Global Methane Pledge launched at COP26 in November 2021. The ROK continues to extend its support to various endeavors with a view to reducing methane emissions in the global LNG value chain, including the Coalition for LNG Emission Abatement toward Net-zero (CLEAN), which is announced on the margin of the 12th LNG Producer-Consumer Conference.

Voluntary commitments

Singapore



Even as we transit to low-carbon energy sources to meet our net-zero commitments, Singapore recognises the importance of natural gas as a transitional fuel source, and the importance of continued investment in natural gas infrastructure and supply chains. The energy crisis has shown us that energy security cannot be taken for granted.

Singapore has endorsed the Global Methane Pledge which seeks to collectively reduce global anthropogenic methane emissions across all sectors by at least 30 percent below 2020 levels by 2030. We have also put in place measures to minimise domestic methane emissions, such as regular leak detection procedures and measures to reduce methane leakages from our gas pipelines.

Singapore will continue to collaborate with like-minded partners to enhance the resilience of LNG supply chains, reduce emissions from LNG use, and promote investments across the LNG value chain.

Voluntary commitments

United States of America



The United States is undertaking ambitious steps to reduce methane emissions from our oil and gas sector, including through a multi-agency initiative (the Greenhouse Gas Monitoring & Measurement Interagency Working Group), strengthened U.S. Environmental Protection Agency (EPA) regulations, and new authorities and incentives created in the Inflation Reduction Act (IRA) and Bipartisan Infrastructure Law (BIL).

Through the IRA, the EPA is providing up to \$1.55 billion in financial and technical assistance to reduce methane emissions throughout the oil and gas sector. The EPA has put forward a new regulatory proposal, “Supplemental Proposal to Reduce Methane and Other Harmful Pollution from Oil and Natural Gas Operations,” that will, among other measures, set a zero-emissions standard for pneumatic devices, require a super-emitter identification and mitigation program, and prevent flaring of natural gas from associated oil wells except under special circumstances. The EPA is also developing a plan to impose a waste emissions charge on the largest methane emitters. Additionally, through BIL, the United States is deploying nearly \$5 billion to plug tens of thousands of orphaned oil and gas wells.

The U.S. Department of Energy’s Office of Fossil Energy and Carbon Management (FECM) is sponsoring up to \$32 million toward the research and development of new monitoring, measurement, and mitigation technologies to help detect, quantify, and reduce methane emissions across oil and natural gas producing regions of the United States.

Abroad, the United States is working with major importing and exporting countries to develop a global framework for measurement, monitoring, reporting and verification of the greenhouse gas intensity of natural gas across the supply chain, from upstream production and processing, through liquefaction and transport, to end uses. The application of this framework will enable the market to value natural gas with verifiable and comparable information on its life cycle GHG supply chain emissions to incentivize improved GHG performance, both within countries and internationally. These measures are intended to increasing awareness and buy-in among stakeholders about both the climate benefits of emissions reduction, and the economic benefits of capturing otherwise lost natural gas.

The United States is still evaluating options regarding the IEA’s role on natural gas security.

Annex

LNG PCC 2023

LNG Producer-Consumer Conference



3. Annex

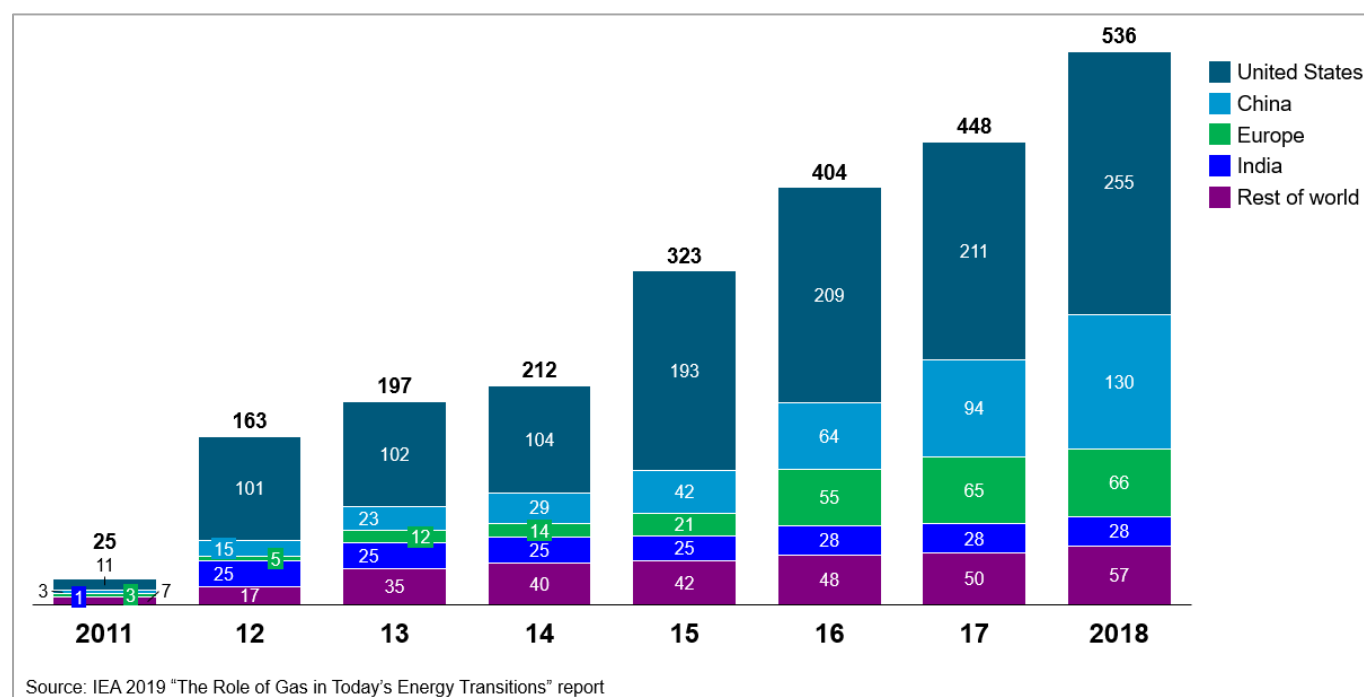
This section of the *LNG Strategy for the World – Chair’s Summary for the LNG-PCC 2023* captures the information and perspectives presented in the preconference workshops covering the bottlenecks in the outlook for LNG and spotlighting the voices of producing and consuming countries. This report serves as documentation by the LNG Producer-Consumer Conference hosts--Japan and the IEA Secretariat—as a contribution to the LNG-PCC.

3.1 Role of gas

To achieve net-zero emissions, each region has its own optimal energy transition pathway. Even with strategies to develop low carbon and renewable hydrogen, natural gas may still play a role in the transition process if it is used appropriately and consistently with climate targets. In that regard, there are four ways in which gas can support energy transition:

- **Serving as transition fuel away from coal and oil** – Natural gas inherently emits fewer pollutants than coal and oil, and CO₂ emissions from combustion of natural gas are almost half that of coal per unit of thermal energy generated. Switching from coal to gas has helped reduce CO₂ emissions. More than 500 million tons of CO₂ emissions have been avoided since 2011 as gas started to replace coal in regions such as the US and Europe, as shown in Exhibit 1.

Exhibit 2: CO₂ savings from coal-to-gas switching by region compared to 2010, MtCO₂⁵



- **Helping integrate more renewable power by providing flexibility** – Gas thermal power plants can provide flexible power, balance demand and supply, and allow and accelerate the addition of intermittent renewable energy such as solar and wind. At the same time, hydrogen and other alternatives that provide flexibility should be developed and adopted in line with the climate goals.
- **Kickstarting a low-carbon and renewable hydrogen/ammonia economy** – Natural gas can be used as feedstock for low-carbon hydrogen and ammonia production, which can serve hydrogen and ammonia

⁵ 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 4.0

demand segments in the short term. This allows hydrogen markets to ramp up rapidly while other more expensive hydrogen technologies (such as renewable hydrogen) continue to scale up and come down in cost.

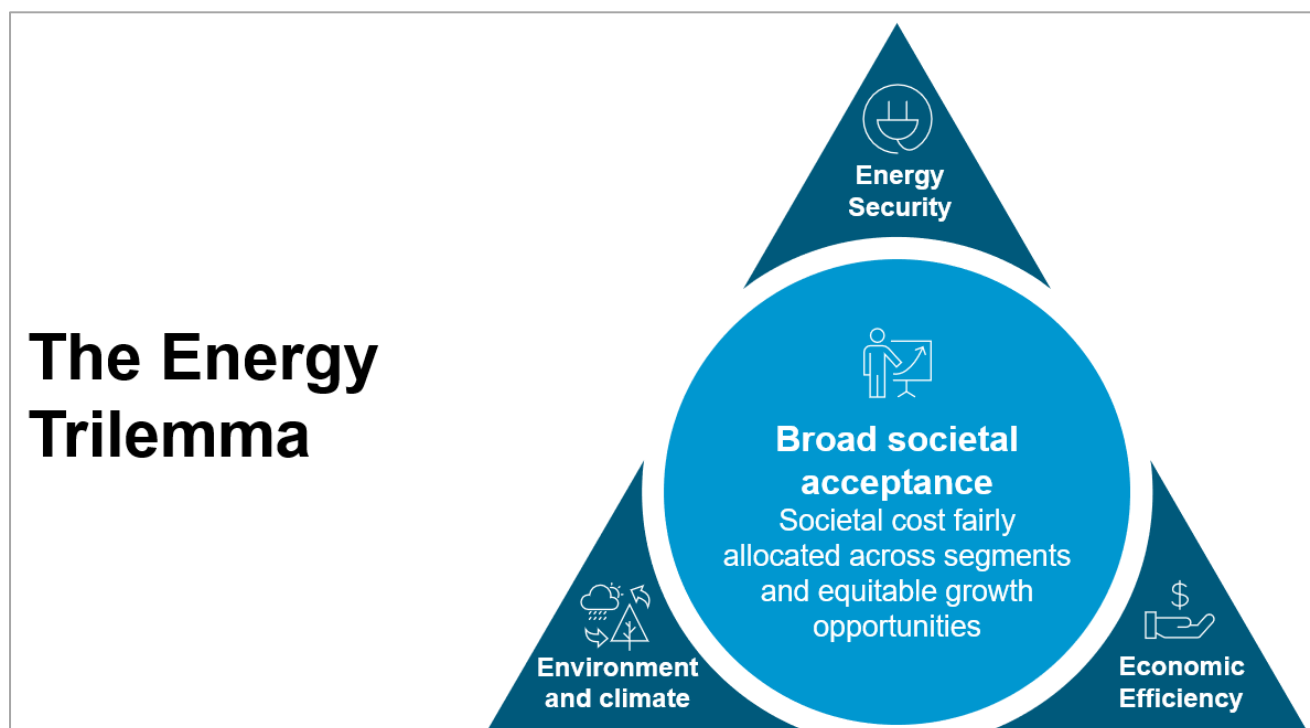
- **Laying the groundwork for low-carbon and renewable gas and CO₂ transport** - Gas networks can serve as versatile carriers of not only natural gas, but also other low-carbon gasses in the future (for instance, by transporting biomethane, hydrogen, or a blend of the two with natural gas or by transporting CO₂ from carbon capture sites to storage locations).

While natural gas may be part of the pathways for some countries to climate targets such as the Paris Agreement, emissions need to be minimized and long-term lock-ins need to be avoided, for instance, by switching to zero or low-carbon fuel or by deploying CCUS.

3.2 Recent trends

In addition to the challenge of achieving net-zero by 2050, nations across the world face the difficulty of achieving a just and orderly transition and overcoming the energy trilemma (energy security, environment and climate risks, and economic efficiency).

Exhibit 3: The Energy Trilemma



Most recently, Russia's war of aggression against Ukraine, which created natural gas/LNG supply shortages affecting industries and households throughout the world, has highlighted the importance of energy security. A continuous dialogue on necessary measures to ensure natural gas/LNG security in the mid- and long-term is necessary to prevent similar future disruptions.

European Union

Russia's war of aggression against Ukraine led to an estimated 83 bcm (~50%) reduction of pipeline gas exported from Russia to OECD Europe in 2022 compared with the previous year.⁶ As a result, European nations had to restructure their gas supply mix with additional imports of LNG, which surged by ~60% to close to 170 bcm in 2022, their highest level on record. This increased demand for LNG tightened the supply-demand balance of the LNG and gas spot market and resulted in TTF spot prices soaring in 2022 to the record high level almost eight times more than their average during 2016-2020, causing demand destruction. Many energy-intensive industries, such as steel production, and other industries, such as fertilizer production, which uses natural gas as feedstock, reduced or suspended operations as costs became prohibitive.

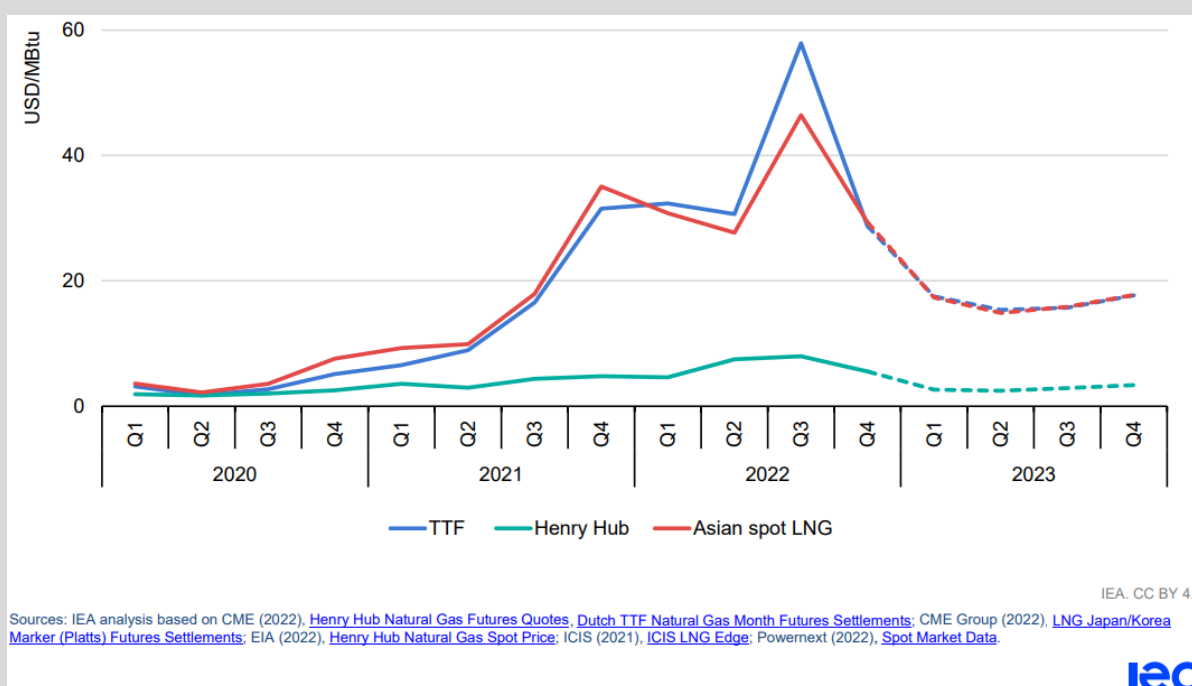
⁶ IEA (2023), *Gas Market Report, Q1-2023*, IEA, Paris <https://www.iea.org/reports/gas-market-report-q1-2023>, License: CC BY 4.0

Emerging economies in Asia

Because LNG has become a global energy commodity over the years, disruptions in the EU gas supply chain after Russia's war of aggression against Ukraine had worldwide economic consequences. Asian spot LNG prices averaged about USD 34/MBtu in 2022, the highest annual level on record and more than five times their average during 2016-2020, significantly affecting emerging Asian economies, which are more sensitive and susceptible to price volatility.⁷ Consider the example of Bangladesh, where more than 50% of its national power is generated by gas from imported LNG.⁸ However, the import of LNG from international spot markets was suspended as prices increased to an unaffordable level, which led to load shedding and a reduction in industrial activities, unsettling the Bangladesh economy and the daily lives of its citizens. Similar challenges with securing LNG as well as FSRUs were experienced by other emerging economies in Asia, such as India and the Philippines.

Exhibit 4: Main spot and forward natural gas prices, 2020-2023, USD/MBtu ⁹

*Note: Forward prices are forecasts only, and the forecast outlook may vary across organizations and countries. The forecasts are only included as potential scenarios and do not represent actual prices in the future.



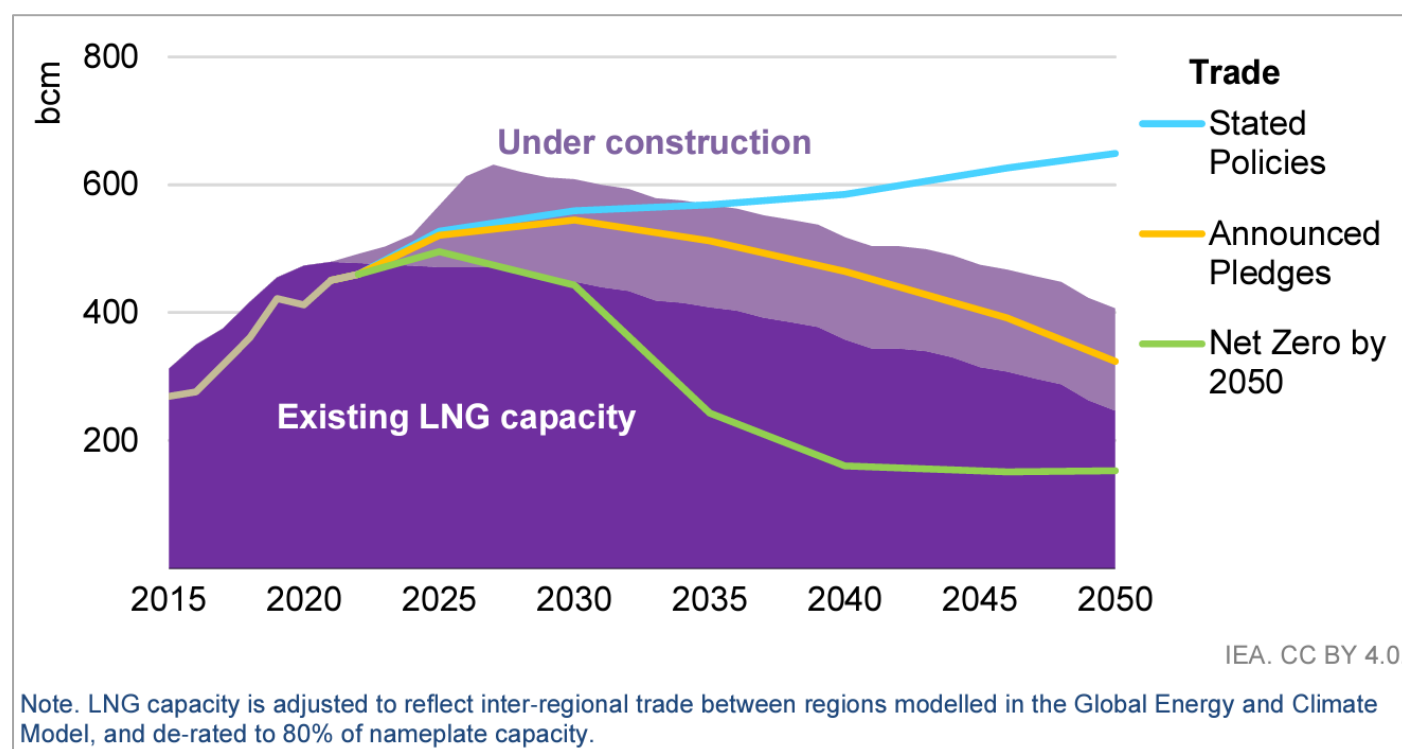
Workshop speakers from the Philippines and Bangladesh conveyed that a stable supply of LNG can be crucial for these emerging economies to sustain socio-economic growth to improve the living standards of their citizens. As their economies grow to catch up with developed countries, so do their needs for affordable energy. However, fossil fuels are difficult to replace with other sources. For example, in Bangladesh, hydropower has vast potential in some regions such as the Himalayas but requires long, in-depth, upfront studies due to potential environmental and social impacts. Renewables likewise face challenges in the Philippines because it is an island nation with mountains and the land usage is prioritized for agriculture. On the other hand, intermittent renewable power requires battery energy storage systems, which are still too expensive for emerging economies, as their grid connection is not always well developed.

The emerging economies also often face challenges in securing financing due to their low credit ratings. Continued investments in natural gas/LNG infrastructure are sought after by these countries to supply affordable energy to enable economic growth, which is a prerequisite for deployment of renewables and other low-carbon energy sources.

3.3 LNG supply demand scenarios

The outlook for global LNG demand varies among multiple climate scenarios, each assuming different decarbonization targets, the pace of technological evolution, and the degree of global cooperation. Public and private sectors have published and studied numerous scenarios, most notably the IEA's *World Energy Outlook 2022* (WEO). In the WEO, the Stated Policies Scenario (STEPS), the Announced Pledges Scenario (APS), and the Net Zero Emissions by 2050 Scenario (NZE) show different evolutions of the LNG supply-demand gap. In STEPS, which shows the future trajectory implied by today's policy settings, an additional 240 bcm per year of LNG export capacity is expected to be needed by 2050 in addition to what currently exists or is under construction. In APS, which assumes that all aspirational targets announced by governments are met on time and in full, the global LNG demand is expected to peak at around 2030 and then decrease, suggesting that currently constructed LNG capacity may be sufficient to meet the future demand. In NZE, which maps out a way to achieve a 1.5 °C stabilization in the rise in global average temperatures, LNG demand should peak in the next few years, implying that existing LNG capacity can mostly satisfy future LNG demand.¹⁰

Exhibit 5: LNG trade by scenario compared to existing and under-construction capacity, 2015-2050, in IEA's Outlooks for gas markets and investment¹¹



This long-term demand uncertainty poses a major risk to natural gas and LNG suppliers and investors, who may decide to withdraw from investing further into upstream development at a faster pace to avoid the risk of stranded assets. Hydrogen/ammonia-readiness preparation may be a potential solution to preventing

⁷ IEA (2023), *Gas Market Report, Q1-2023*, IEA, Paris <https://www.iea.org/reports/gas-market-report-q1-2023>, License: CC BY 4.0

⁸ Bangladesh Power Development Board, *Annual Report 2021-2022*, https://bpdh.portal.gov.bd/sites/default/files/files/bpdh.portal.gov.bd/annual_reports/7b792f67_bf50_4b3d_9bef_8f9b568005c9/2022-11-29-05-22-0dea17e09d8a84e72a63312df6b5bdc6.pdf

⁹ IEA (2023), *Gas Market Report, Q1-2023*, IEA, Paris <https://www.iea.org/reports/gas-market-report-q1-2023>, License: CC BY 4.0

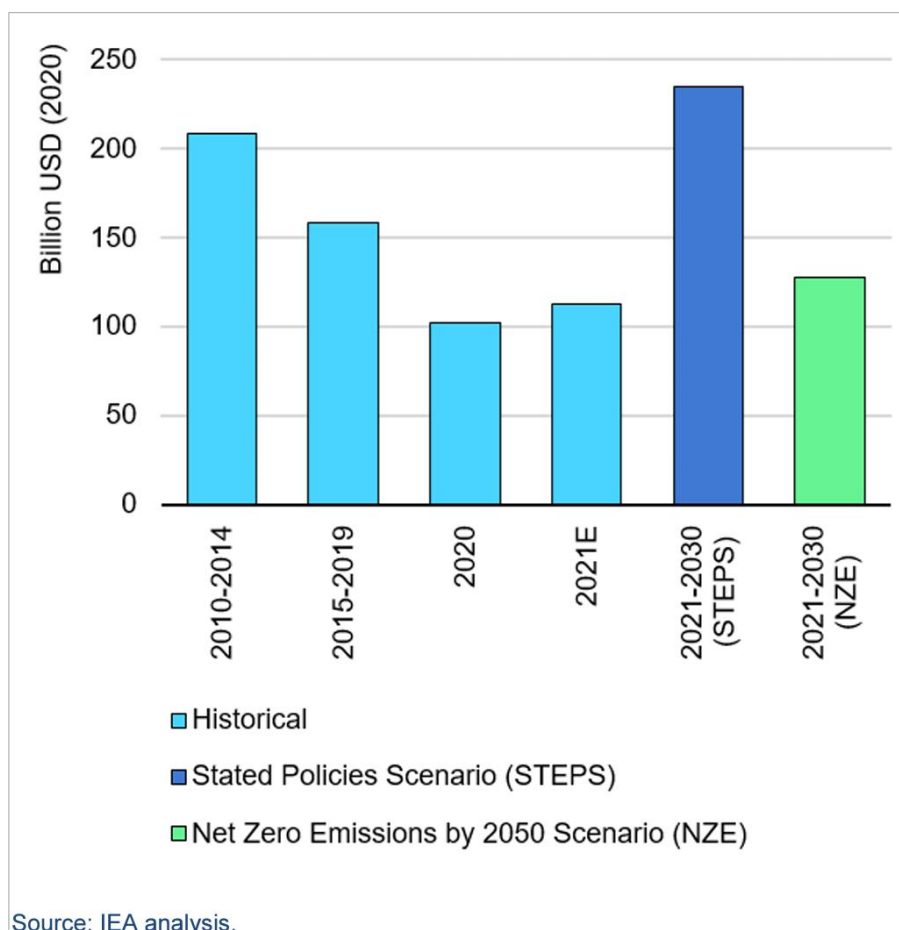
¹⁰ IEA (2022), *World Energy Outlook 2022*, IEA, Paris <https://www.iea.org/reports/world-energy-outlook-2022>, License: CC BY 4.0 (report); CC BY NC SA 4.0 (Annex A)

¹¹ IEA (2023), *Outlooks for gas markets and investment*, IEA, Paris <https://www.iea.org/reports/outlooks-for-gas-markets-and-investment>, License: CC BY 4.0

natural gas and LNG facilities from becoming stranded assets. However, an adequate consideration in advance is critical due to the technical modifications required.

If investment into natural gas/LNG is insufficient, a supply tightness could occur before a demand decline, putting global energy security at risk. As the *IEA Gas Market Report Q1 2022* noted, “gas-related upstream spending is less than half of what is required annually under the IEA Stated Policies Scenario (STEPS), and 12% lower than the amount consistent with the Net Zero by 2050 Scenario (NZE) in the 2021-2030 period,”¹² as shown in Exhibit 5.

Exhibit 6: Annual upstream investment in natural gas supply in the IEA’s *Gas Market Report, Q1-2022*¹³



3.4 Bottlenecks in the LNG business

Besides the uncertain demand outlook and investment environment, other potential bottlenecks could further exacerbate the supply/demand gap and affect energy security. These potential bottlenecks were investigated across five categories: demand, supply, finance, energy security, and decarbonization. Each of these categories is explained in the following section.

3.4.1 Demand

- 1. Demand uncertainty depending on scenarios:** As previously described in Annex Section 4.3, the LNG demand outlook to 2050 varies significantly across scenarios, which makes it difficult for project

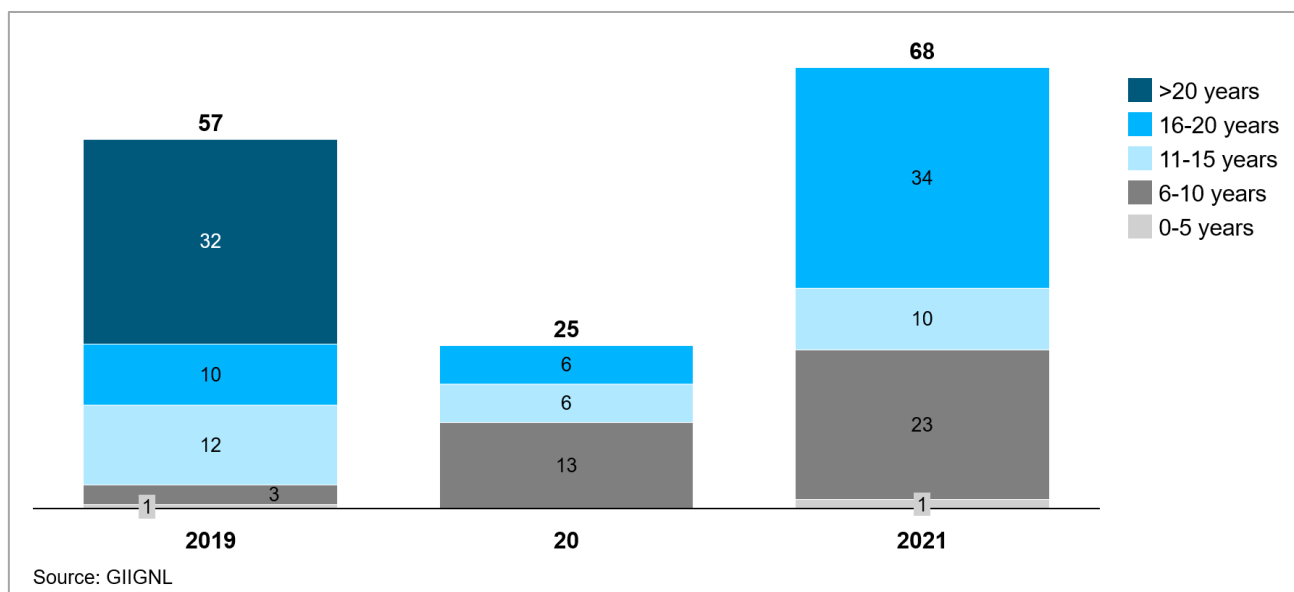
¹² IEA (2022), *Gas Market Report, Q1-2022*, IEA, Paris <https://www.iea.org/reports/gas-market-report-q1-2022>, License: CC BY 4.0

¹³ IEA (2022), *Gas Market Report, Q1-2022*, IEA, Paris <https://www.iea.org/reports/gas-market-report-q1-2022>, License: CC BY 4.0

developers and financial institutions to make investment decisions. As pointed out by multiple producing countries in one of the workshops, it is difficult to ramp up production of LNG in a short period. Therefore, it is important to recognize that the world may risk facing prolonged periods of supply shortages if actual demand turns out to be higher than forecasts or expectations.

2. **Mismatch in the desired contract length:** Even compared to other energy-related investments, LNG projects require high capital expenditures (CAPEX), often requiring multiple billions USD in investments by developers. Project financing has been a common approach to fund such megaprojects. To obtain such financing, an LNG project typically requires offtake contracts lasting 15 to 20 years or longer to demonstrate stable cash flows. As a result, the majority of LNG contracts signed are for longer than 10 years, as shown in Exhibit 6.





Exhibit 7: LNG offtake contracts signed by duration by year, Mtpa¹⁴



In contrast, short-term contracts tend to be signed with brownfield projects because they have already recovered a large share of the investments and can contract the remaining production on a short-term and flexible basis, as summarized in Exhibit 7.

¹⁴ International Group of Liquefied Natural Gas Importers, Knowledge Center, Contracts, <https://giignl.org/market-trends/contracts/>

Exhibit 8: LNG offtake contracting needs and examples by project type

| | Contracting needs | Example | Expert comments |
|---|---|---|---|
| Newly developed project (Greenfield) | <ul style="list-style-type: none"> • 15 years+ long-term SPAs typically required before FID • Need to demonstrate security of income to investors for project financing | <p>Corpus Christi (20 years) </p> <p>Calcasieu Pass (19 years) </p> | <p>④ Almost all new LNG projects in the US are backed by long-term contracts lasting at least 15 years, otherwise developers cannot get the required financing</p> <p>– US LNG project developer</p> |
| Operational project (Brownfield) | <ul style="list-style-type: none"> • Sellers can sign long- or short-term SPAs as security of cash flow is not necessarily required • Developers have greater control over their uncontracted LNG volume and can optimize trade | <p>Oman LNG (6 years) </p> <p>ADNOC LNG (3 years) </p> | <p>④ Once developers have paid off all debts, in general, companies with trading capability have potential to make more profit by selling short-term or on spot</p> <p>– LNG trading expert</p> |

Source: Expert interviews, CEDIGAZ

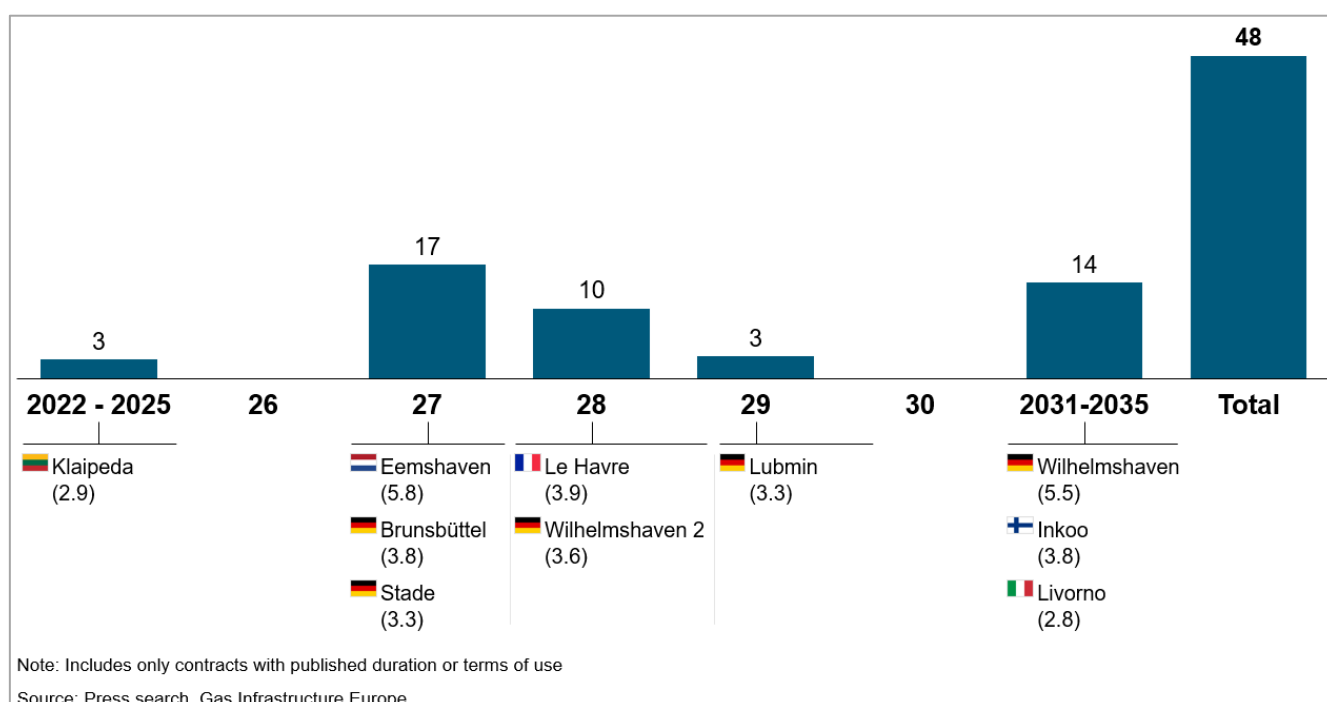
Signing such long-term contracts today may conflict with the decarbonization targets of buyers who are increasingly seeking shorter-term contracts. But this may pose a challenge to LNG project developers as they secure financing, which could impact development of LNG projects. Shortening of the contract period requires a shortening of the payback period, which could in turn lead to price increases for LNG buyers.

One reason why LNG businesses require long-term contracts is insufficient market liquidity. The formation of a liquid LNG market by, for example, improving price transparency and flexibility of contract terms, could potentially alleviate the need for long-term commitments. Despite the low market liquidity of LNG compared with other commodities such as oil, the role of portfolio players and traders in LNG supply is increasing, with the contracted volume by the top four portfolio players (TotalEnergies, Naturgy, Shell, and BP) and the top four LNG trading houses (Glencore, Gunvor, Trafigura, and Vitol) reaching 76 Bcm in 2023. Additionally, innovations in commercial contracts could increase their flexibility, such as seasonal energy contracts that would allow sourcing extra supply and provide flexibility during the high demand winter season.¹⁵

3. **Need for additional LNG import and regassification facilities:** Further investments in LNG import and regassification facilities will likely be required in Southeast Asia and South Asia, which have the potential to emerge as new LNG demand centers. However, construction of new LNG terminals is a long and complicated process, with high risk of delays and cancellations, potentially causing an import infrastructure bottleneck.

¹⁵ Center on Global Energy Policy, *Beyond Spot vs. Long Term: Europe's LNG Contracting Options for an Uncertain Future*, Jun. 14, 2023, <https://www.energypolicy.columbia.edu/publications/beyond-spot-vs-long-term-europes-lng-contracting-options-for-an-uncertain-future/>

Exhibit 9: End-of-contract FSRU capacity by year, Mtpa



One potential way to mitigate such risks is by relocation of existing Floating Storage and Regasification Units (FSRUs). FSRUs can be deployed faster and with less land modification than constructing onshore LNG terminals. FSRUs recently chartered in Europe on a short-term basis, partly as a response to the energy crisis, have a potential to provide ~50 Mtpa additional import capacity by 2035 if relocated after expiration of their current contracts.

3.4.2 Supply

1. **Increasing costs of LNG projects:** LNG project costs have been escalating for the past 20 years globally, negatively affecting the profitability of LNG projects. Industry experts attribute these higher costs to increases in equipment, material (commodities), labor, and freight prices. Based on the combination of projects already under construction and the momentum of potential projects, US LNG capacity could grow between 70 Mtpa and 190 Mtpa before the end of the decade, potentially more than doubling current exports, according to a Wood Mackenzie report.¹⁶ To achieve this, a number of new projects will have to launch, which could lead to as much as 100 billion USD in new projects in the next five years. Current US project cost increases may have an impact on the stable supply of LNG. Wood Mackenzie's benchmarking analysis indicates significant inflation in the cost of US Gulf Coast projects built in the last five years. The increase in project costs suggests that the hurdle for an FID could be higher than before as project developers (LNG suppliers) would need to secure more funds, leading to higher offtake prices for buyers and potentially making it difficult to obtain adequate project financing.
2. **Potential constraints in the US pipeline capacity impacting the US LNG projects:** With US projects expected to form the bulk of new LNG supply projects, it is important to understand potential upstream and midstream stumbling blocks in the US. The US Gulf Coast is the major production and export location for new LNG (specific projects are detailed in 4.4.4), with feed gas via pipelines mainly from the Appalachian and Permian basins. Increase of gas supply by pipelines is a critical prerequisite for a new supply of LNG. But the pipeline capacity from Appalachia to the Gulf Coast could be a constraint by the late 2020s. In the past five years, some pipeline projects have experienced cancellations or delays due

¹⁶ Wood Mackenzie, *Third wave US LNG: A \$100 billion Opportunity*, Feb. 22, 2023, <https://www.woodmac.com/news/opinion/third-wave-us-lng/>

to increasing regulatory headwinds and local community opposition. If there are pipeline project delays/cancellations, then that would limit the gas availability to LNG liquefaction plants.

Exhibit 10: Major gas flow to Gulf Coast in the US

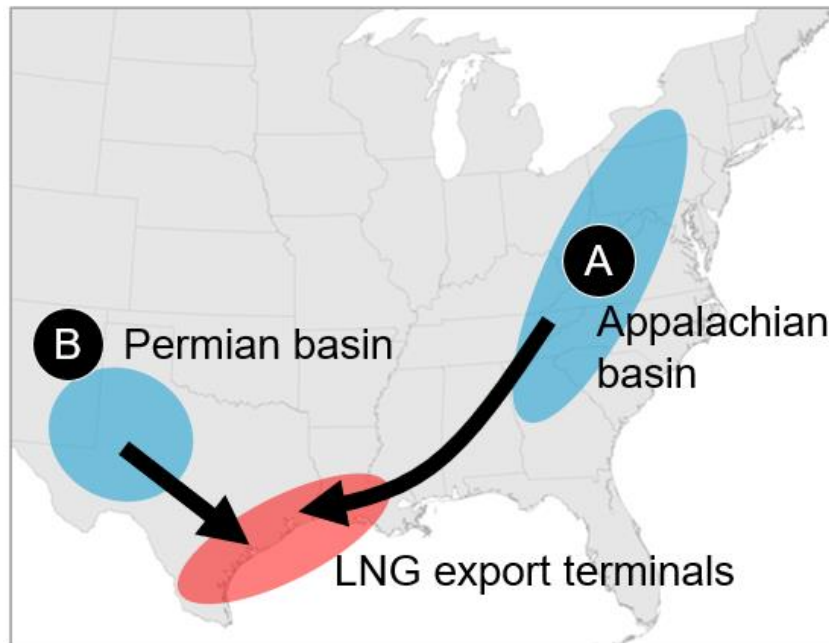


Table 1: Examples of major Appalachian gas pipelines experiencing regulatory headwinds

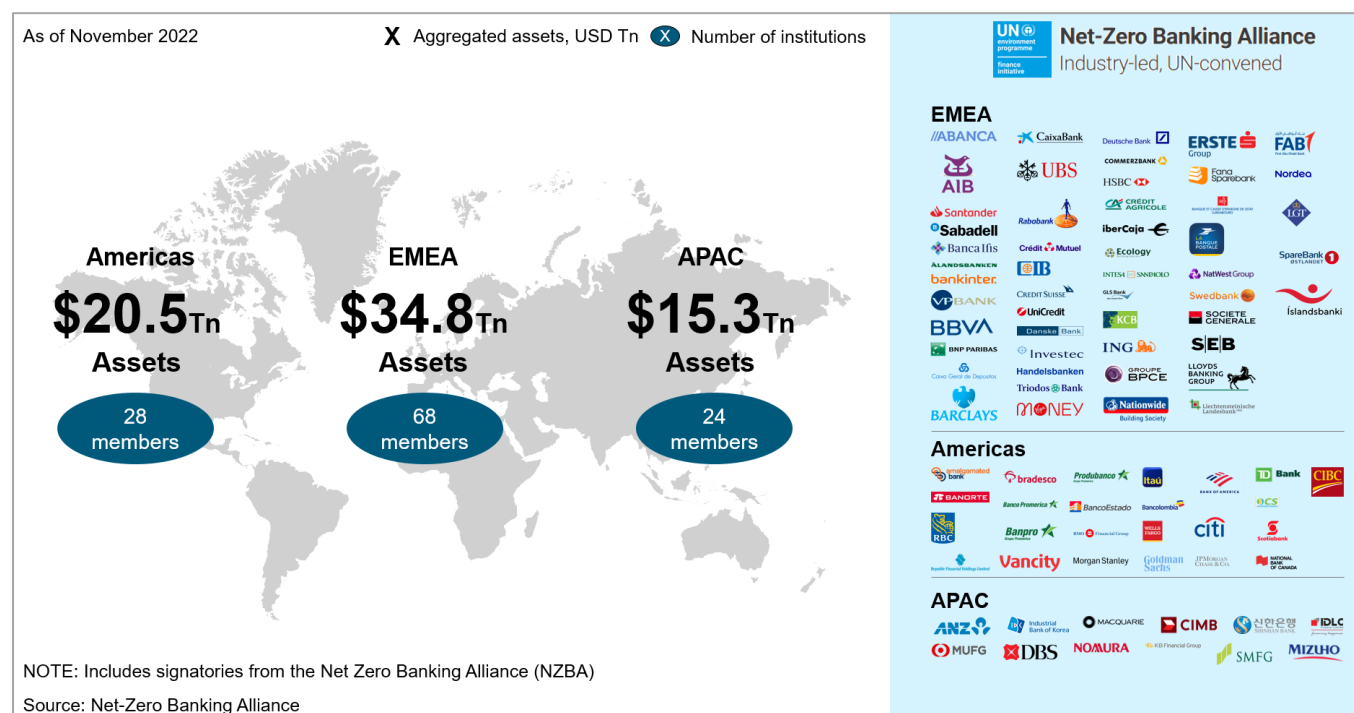
| Pipeline | Location | Details | Impact on in-service / completion date |
|--------------------------------|---|---|---|
| Atlantic Coast Pipeline | W. Virginia, Virginia, N. Carolina, and S. Carolina | Conflicting rulings between federal courts and the US Forest Service in Feb 2019 stalled development, causing over \$1B budget increase ; even after appeals to the US Supreme Court, the project was eventually cancelled | <ul style="list-style-type: none"> • Announced: Q2 2019 • Expected: early 2021 • Cancelled: July 2020 |
| PennEast Pipeline | Pennsylvania and New Jersey | 10-month opposition from NJ attorney general and 100+ homeowners, resulting in a federal appeals court granting a stay in March 2019, halting construction; after US Supreme Court hearings through 2021, New Jersey Resources (NJR) ended project | >2 years <ul style="list-style-type: none"> • Announced: Q1 2019 • Cancelled: Sept. 2021 |
| Mountain Valley Pipeline (MVP) | West Virginia and Virginia | In 2018, a federal appeals court struck down a US Forest Service permit that allowed the pipeline to cross through the Jefferson National Forest, causing the Federal Energy Regulatory Commission (FERC) to issue a stop-work order . At the end of May 2023, the US Senate agreed to compel federal agencies to approve all remaining permits needed for the construction of the pipeline. | >2 years <ul style="list-style-type: none"> • Announced: Q4 2018 • Expected: 2023-24 |

(Source: Company websites, Press search)

3.4.3 Finance







1. **Concerns with financed emissions “lock in”:** As financial institutions set net-zero commitments for 2050 and disclose their pathways, investments into LNG face challenges. Financing LNG projects would “lock in” emissions in the long term, becoming a conflict with the institution’s net-zero pathways. For example, some of the major financial institutions that are part of the Net-Zero Banking Alliance (NZBA) have set their net zero targets for 2050 and interim targets for 2030. To avoid lock-in issues, these banks may hesitate to provide long-term financing for LNG projects to avoid the risk of stranded assets, even if they have relatively lower emissions than other LNG projects or are essential for energy security. This conflict needs to be overcome for necessary and proper financing on LNG projects.

Exhibit 11: Net zero commitments by major banks as of November 2022



2. **Unclear positioning of natural gas/LNG in policy schemes:** The role of natural gas/LNG as transition fuel has not been defined at a global level, and banks across regions/countries are taking different financing approaches on natural gas/LNG. Experts in the LNG industry point out the increasing need for governments to play a role in helping set a clear pathway for LNG. Such clarity, along with policy measures, could be the key to overcoming lock-in issues.

Exhibit 12: Experts' voices on financing LNG projects based on Japan's research

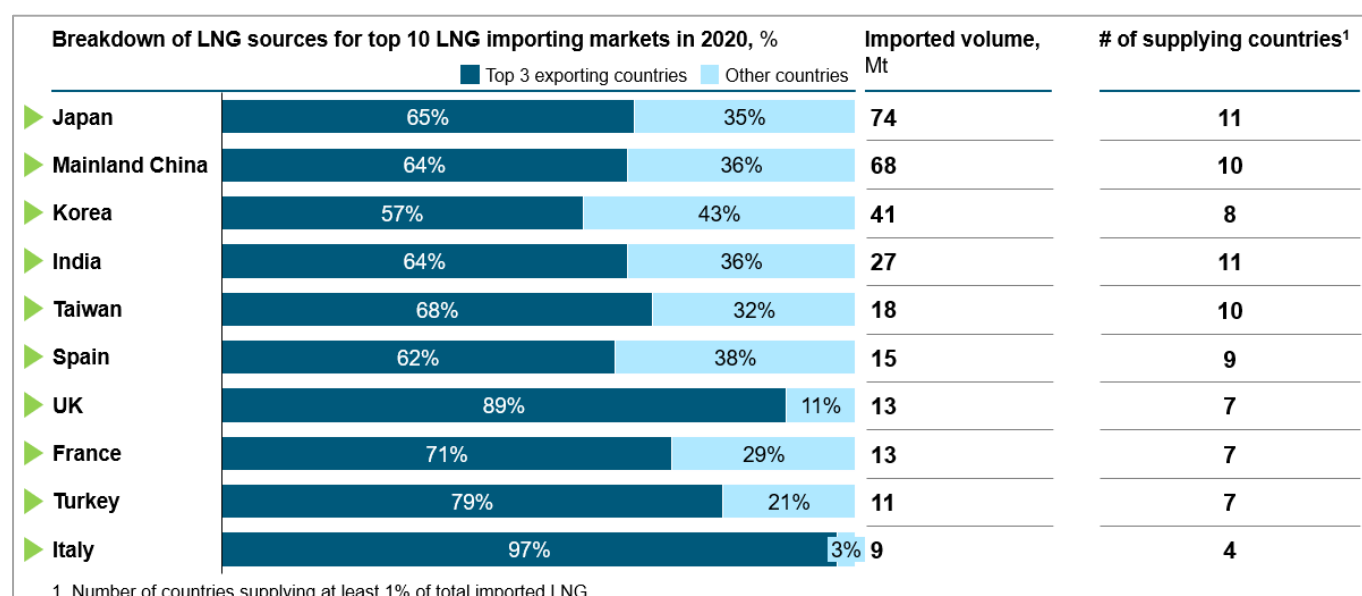
| | | |
|---|---|--|
| <p>Government's role is becoming larger</p> | <p> Banks take into consideration the government's net zero targets in their own pathways. If governments signal that gas/LNG is critical for transition, banks' policies may change</p> <p>— Project finance expert in an ECA</p> | <p> To avoid "lock-in" issues, clear methodologies to assess gas/LNG project could help balance energy security and decarbonization</p> <p>— Finance expert in a development bank in Asia</p> |
| <p>Financing LNG matters for energy transition & security</p> | <p> The world relies on LNG as transition fuel to support developing economies. There will be many LNG-related projects. If there is demand, banks can finance with abatement conditions for carbon emissions</p> <p>— Expert at multilateral development bank</p> | <p> Since the conflict in Ukraine, European countries are keen to secure LNG. In reality, while we pursue long-term decarb target, financing gas is important for transition</p> <p>— Expert in a major European commercial bank</p> |
| <p>Advanced economies' push to net-zero could affect Asian countries</p> | <p> G7 countries have committed not to provide public finance to new unabated fossil fuel projects from 2023, so financial constraints could increase for new projects, especially in Asian developing countries</p> <p>— Project finance expert in an ECA</p> | <p> While European countries are phasing out their funding from new gas projects, those projects are funded by other banks, e.g., banks in Asia where the demand is increasing</p> <p>— Finance expert at multilateral development bank</p> |

Source: Expert interviews conducted for Japan's research (Interviewees were asked the following questions: (1) What are the key bottlenecks behind today's unstable global LNG market? (2) What could be the solutions to unlock these bottlenecks? (3) How are financial institutions working towards their decarbonization pathway?

3.4.4 Energy security

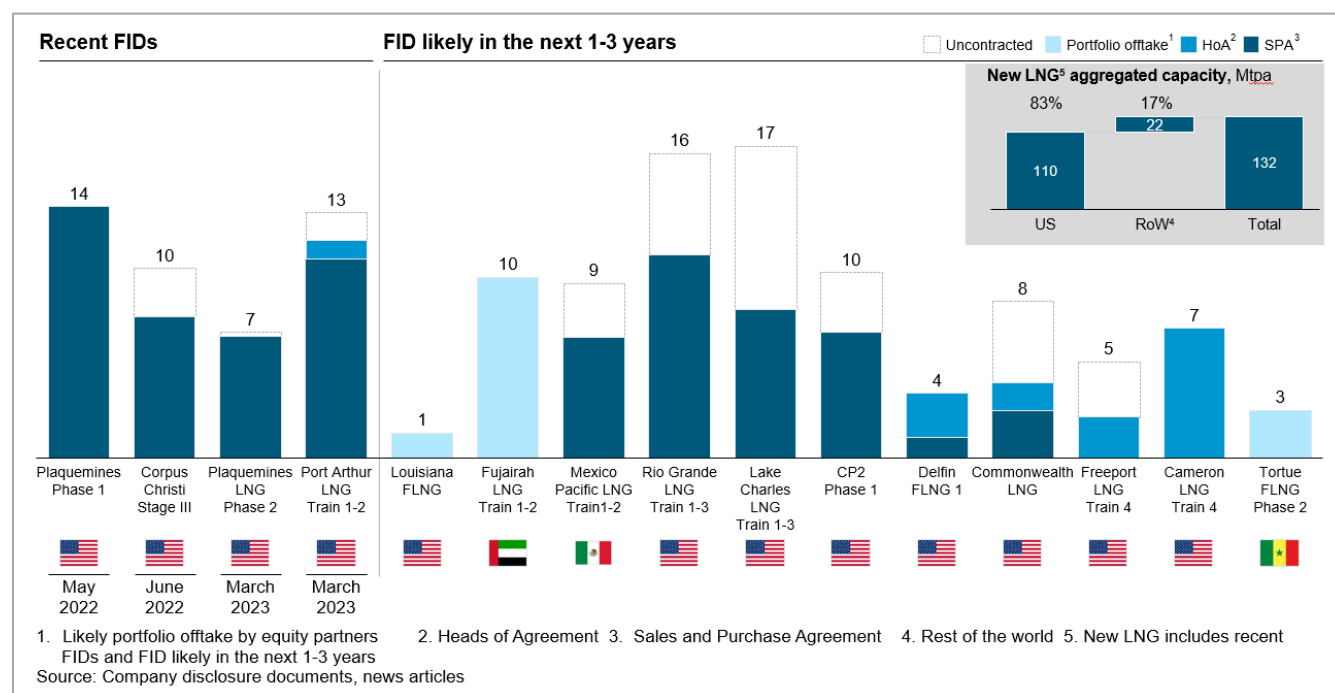
1. **Maintenance of LNG supply diversification:** Currently, major LNG importing countries have diversified portfolios, sourcing from about 10 countries spread across multiple continents, which reduces geographical and geopolitical supply risks.

Exhibit 13: LNG supply sources for top 10 LNG importers in 2020¹⁷



However, over 70% of LNG project FIDs that are likely to take place in the next 1 to 3 years may be in the US, partly due to the cost competitiveness of US shale gas and declining investment into conventional gas fields. Balanced investment into LNG projects could help maintain a diversified and robust portfolio of global LNG supply. In the preconference workshop, LNG producers emphasized that diversification of supply sources and of price indices was also a key lever for energy security.

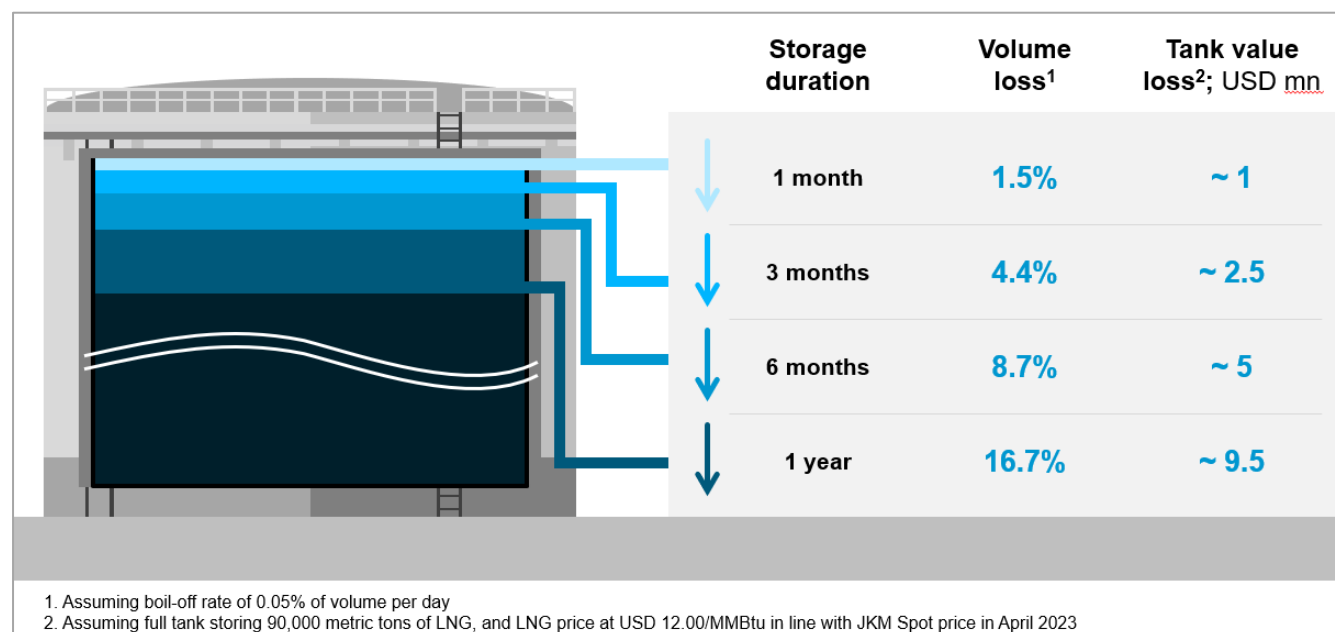
Exhibit 14: List of pre-FID LNG projects based on public releases as of May 2023, Mtpa



- Difficulty of storing LNG in the long term:** Due to its extremely low temperature (approximately -162 °C), LNG stored in a tank naturally boils off, reducing its volume and value over time. Hence, it is economically inefficient to store LNG as a long-term reserve, making it difficult for countries without access to gas storage systems to flexibly respond to short-term fluctuations of gas demand.

¹⁷ International Group of Liquefied Natural Gas Importers, *GIIGNL 2022 Annual Report*, May 24, 2022, <https://giignl.org/document/giignl-2022-annual-report/>

Exhibit 15: Boil-off loss associated with long-term storage of LNG



Alternative measures such as flexible upstream contracts or international collaboration to adjust supply deficit/surplus may be necessary to enhance energy security.

3.4.5 Decarbonization

- Inadequate regulations and incentives and inconsistent frameworks for GHG reduction:** Most GHG emissions along the LNG value chain occur during the extraction, processing, and liquefaction of natural gas. Introduction of CCUS or electrification of facilities, as well as reduction of fugitive methane emissions, could play an important role in reducing the overall GHG footprint.

The importance of reducing fugitive emissions along the LNG supply chain, including methane emissions, is widely acknowledged and seen as a cost-effective way for climate action. IEA highlights that “about 80% of the options to reduce emissions from oil and gas operations worldwide could be implemented at no net cost.”¹⁸

¹⁸ IEA (2023), *Global Methane Tracker 2023*, IEA, Paris <https://www.iea.org/reports/global-methane-tracker-2023>, License: CC BY 4.0

IEA sees reducing methane emissions could be a cost-effective way for climate action



Global Methane Tracker (2022)

- Oil and gas **methane emissions represent one of the best near-term opportunities for climate action** because the **pathways for reducing them are well-known and cost-effective**. Even if there was no value to the captured gas, almost all available abatement measures would be cost effective in the presence of an emissions price of only about 15 USD/tCO₂-eq
- Based on the record gas prices seen around the world in 2022, we estimate that **about 80% of the options to reduce emissions** from oil and gas operations worldwide **could be implemented at no net cost**. Around USD 100 Bn in investment is required to 2030 to **deploy all methane abatement measures** in the oil and gas sector. **This is less than 3% of the net income received by the oil and gas industry in 2022**

Emissions from Oil and Gas Operations in Net-Zero Transition (2023)

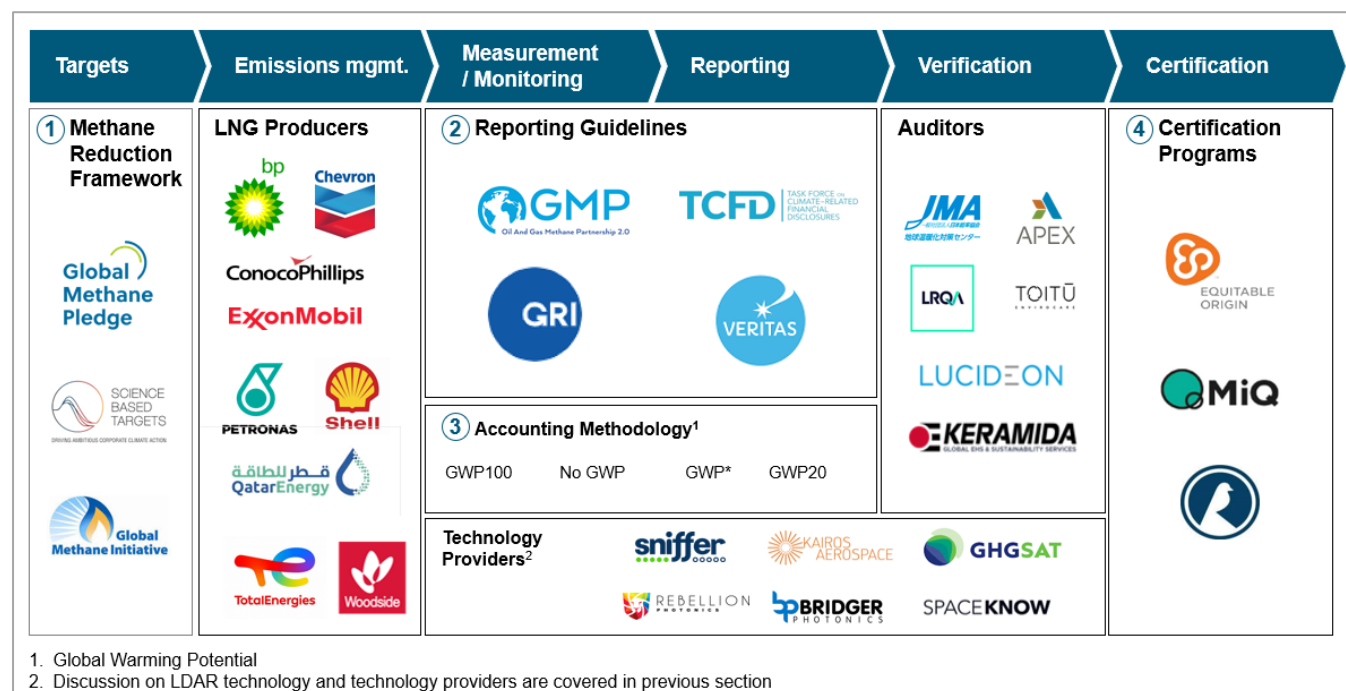
- Tackling methane emissions is the single most important measure that contributes to the overall fall in emissions from oil and gas operations**, followed by eliminating flaring and electrification. Scaling up CCUS and expanding the use of low-emissions hydrogen play complementary roles but have significant potential for positive spillovers into other aspects of energy transitions, by accelerating deployment and technology learning for these technologies

Source: IEA (2023), *Global Methane Tracker 2023*, IEA, Paris <https://www.iea.org/reports/global-methane-tracker-2023>, License: CC BY 4.0. IEA (2023), *Emissions from Oil and Gas Operations in Net Zero Transitions*, IEA, Paris <https://www.iea.org/reports/emissions-from-oil-and-gas-operations-in-net-zero-transitions>, License: CC BY 4.0

However, current regulations and incentives may not be sufficient for producers to make capital investments to reduce emissions.

In addition, hampered by the absence of a standardized industrial framework for measurement, monitoring, reporting, and verification (MMRV) of emissions, fugitive emissions along the value chain cannot be adequately and uniformly recorded and reported. Global cooperation toward standardization can help LNG producers and consumers take further actions.

Exhibit 17: Methane MMRV value chain (selected examples)

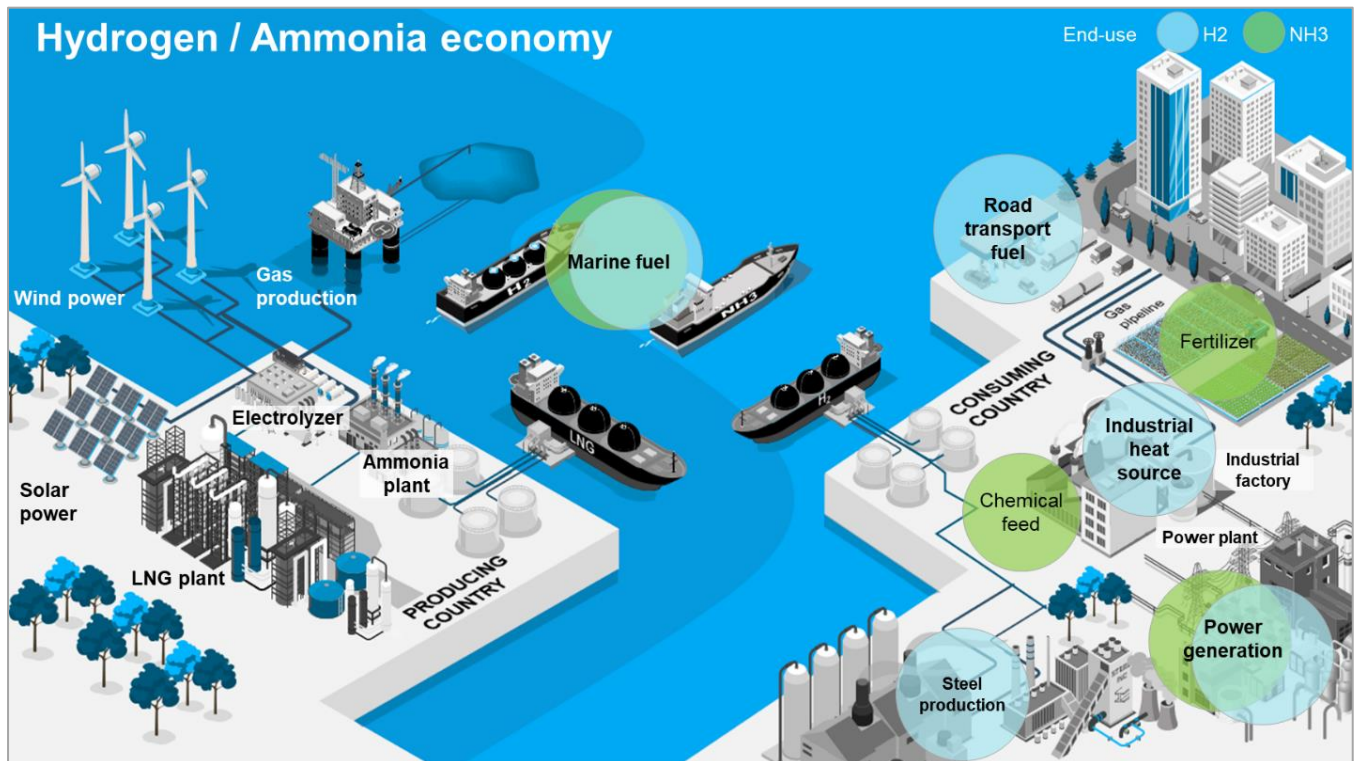


- 2. Technical challenges in methane leakage detection:** Fugitive emissions occur at numerous points across LNG facilities and the natural gas value chain, making it technically challenging and costly to precisely detect and monitor. In addition to existing technologies such as LDAR (leak detection and repair) practices, a variety of new technologies as well as improvements to existing ones, such as LiDAR (Light Detection and Ranging), are currently under study and development, which could help natural gas and LNG producers detect methane leakage more accurately if deployed at a commercial scale.

3. **Transition to renewable/low-carbon hydrogen and ammonia:** The uncertainty arising from energy transition means that investors may not invest across the entire value chain. Existing assets and infrastructure including natural gas and LNG facilities face stranded asset risk. To avoid such risk and ensure that LNG can contribute to net-zero by 2050, LNG will need to transition to hydrogen and ammonia as much as possible.

LNG and natural gas can be converted into low-carbon hydrogen or ammonia, which will contribute to the gradual shift toward a hydrogen/ammonia economy. However, this is not an easy process, as these fuels all have different properties. Extensive global cooperation will likely be required to enable the transition. Some of the challenges may be alleviated through adequate planning in advance for gas infrastructure, for example, ports and vessels, that may be utilized for hydrogen or ammonia in the future.

Exhibit 18: Hydrogen and ammonia economy



3.5 Closing and disclaimer

The *LNG Strategy for the World – Chair’s Summary for the LNG-PCC 2023* serves as a summary document by the chairmen of the LNG-PCC, Japan and the IEA Secretariat. This document covers potential LNG bottlenecks and challenges discussed during the IEA Workshops preceding the LNG-PCC as well as a compilation of voluntary commitments submitted by the participating countries in the conference. It is not an agreement communiqué of the IEA and does not necessarily represent the views of the IEA, nor the entirety of its member countries, association countries, the LNG-PCC attendees from non-IEA countries, or other stakeholders. It serves as reference material to be considered by the IEA TFFS for its continued efforts to strengthen the resilience of natural gas systems and is not a formal recommendation by the IEA.

Exhibit 19: Preconference workshops and the LNG Producer-Consumer Conference

