LNG supply security challenges in the Asia Pacific region

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Session 2: Gas supply security issues in Asian markets

IEA Workshop on Gas Supply Security

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This presentation represents only the author's view and does not represent views of IEEJ. The author can be reached at:

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Outline

- ✓ **Elements of LNG Supply Security in the Asia Pacific Region**

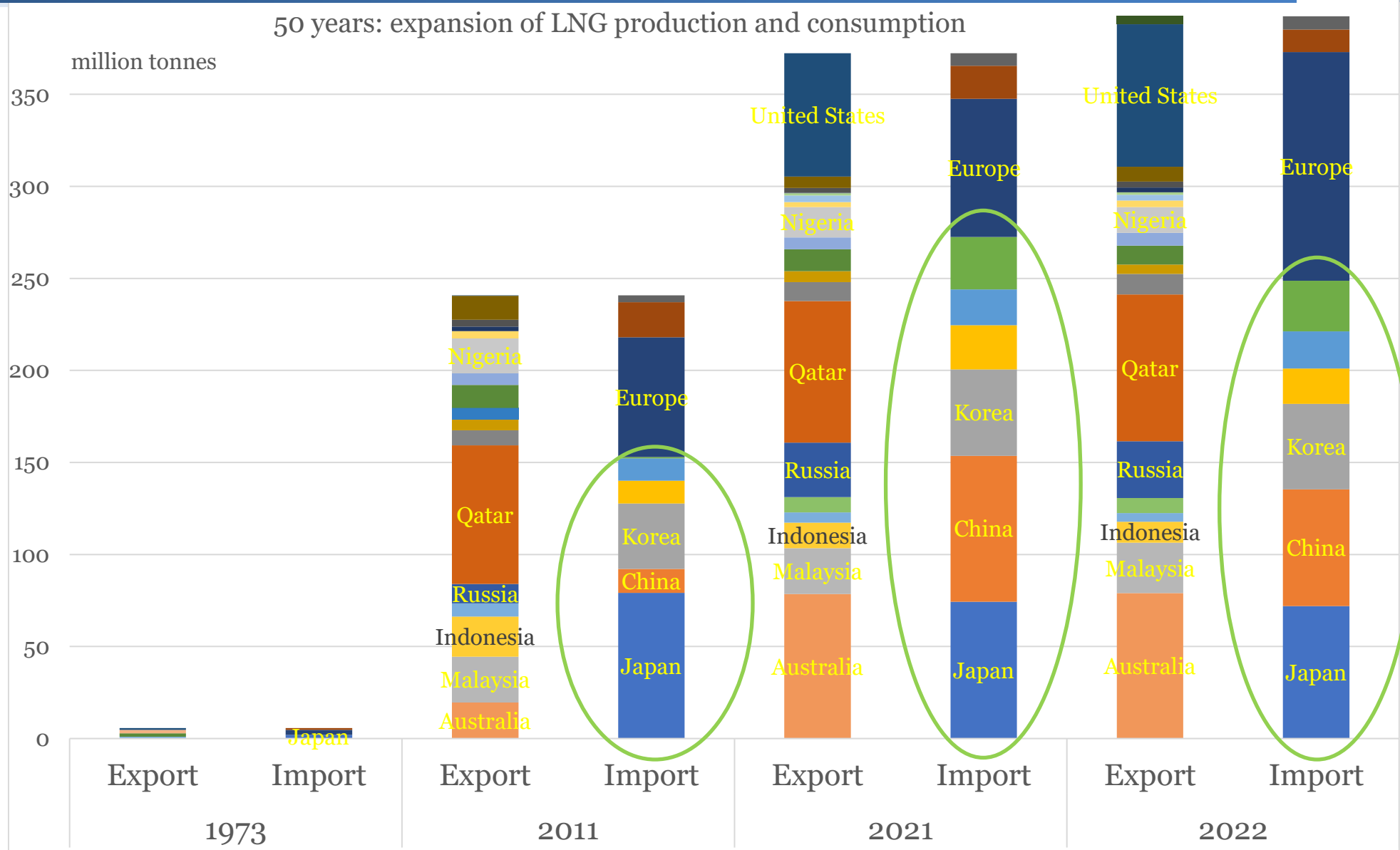
- ✓ **Status of LNG Markets - Historical and Current**
  - Major LNG Consuming and Producing Regions - 50 Years
  - The Rapid Rise in Value of the LNG Market
  - Changes in LNG Imports in Major Consuming Countries and Regions
  - Changes in LNG Imports in Southeast and South Asia
- ✓ **Consideration over Future LNG Production Projects**
  - Trends of LNG Production Projects - Development and Costs
  - Securing Greener LNG Production Projects
  - Major Current and Future LNG Supply Sources
  - LNG Production Investment and Term Contracts Are On The Rise
  - Japanese LNG Procurement Tends to Rely on Partnerships and Portfolio Players
- ✓ **Logistical Issues Responding to Changing LNG Supply Sources**
  - Huge Benefit of the Panama Canal - As Well As Bottlenecks
  - Longer Transportation Distances and Bottlenecks Make Optimization Essential
- ✓ **Toward LNG market stabilisation - long-term challenges**
  - G7 Ministerial Communique Underwrites Importance of Natural Gas
  - IEA's Role for Security of Supply: Oil vs Natural Gas / LNG
  - Toward Long-Term Stability and Further Growth of the LNG Markets

Elements of LNG Supply Security in the Asia Pacific Region

1. **Supply sources** - Some major gas consumers do not have their own and/or nearby gas resources. Production and consumption centres are not often connected by pipelines
2. **Diversification of supply sources** - As natural extension of the scarcity of domestic sources, LNG importing countries have procured LNG from different producers
3. **Availability and affordability of supply** - Available and affordable supply now depends not only on supply sources but also on demand fluctuations in other major consuming markets, notably the European Union
4. **Transportation infrastructure** - Bulk transportation is more dependent on LNG than big-diameter pipelines
5. **LNG terminals** have been constructed attached to major consuming centres basically separated with each other - rather than part of integrated infrastructure with trunkline transmission pipelines
6. **Gas storage capacity** - Most countries in the region do not have significant underground gas storage facilities. Some countries have already significant LNG storage tanks that can serve as security buffer. Different reserve buffers have been considered
7. **Well-functioning market** - Some experts say a well-functioning market can provide security of supply. The global LNG market has functioned well in the last two years - in favourable to Europe but not necessarily so to some Asia Pacific markets
8. **Flexibility of LNG contracts** (regarding destination restrictions) - Flexibility is certainly increasing - again in favourable to Europe at least for the last two years

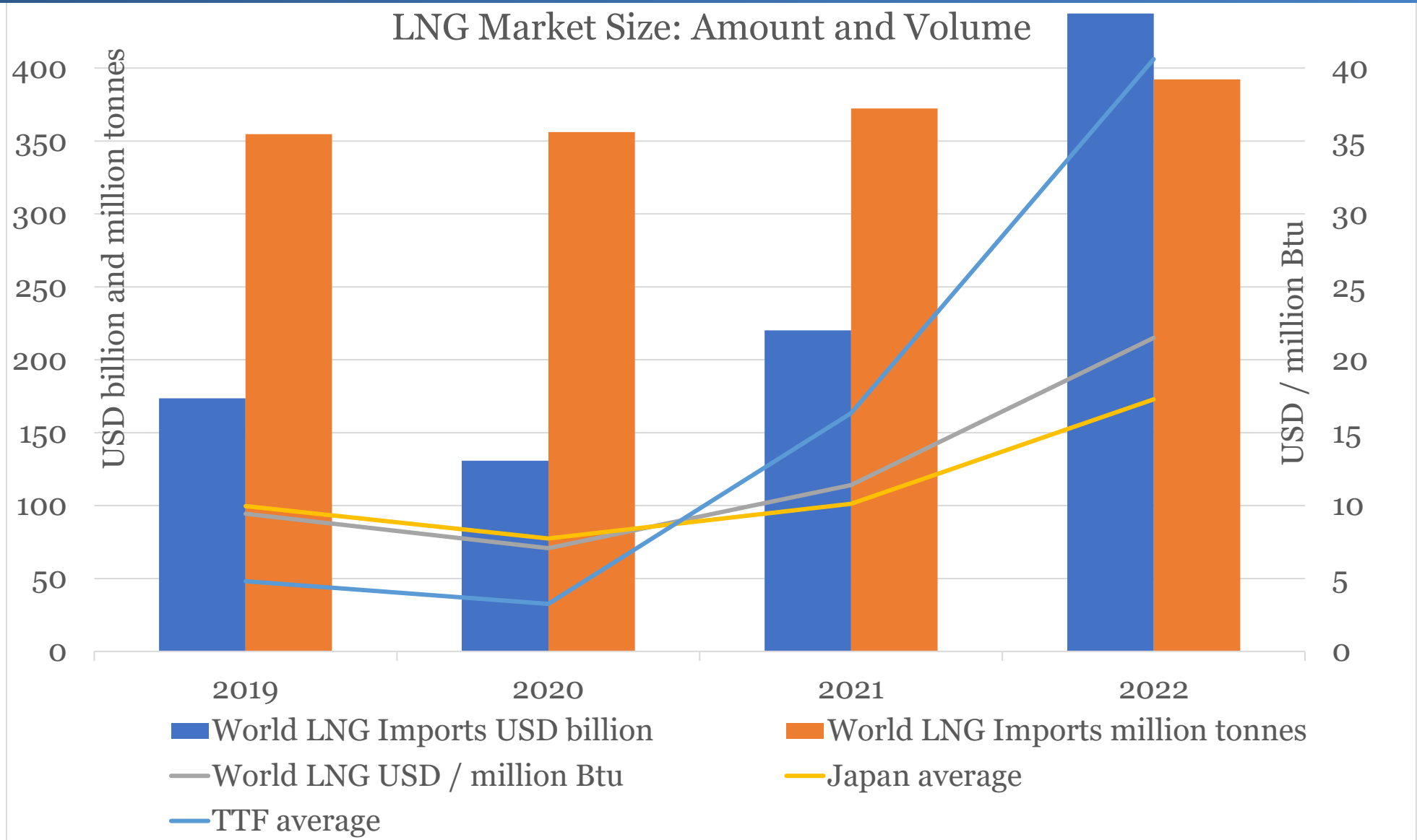
Major LNG Consuming and Producing Regions - 50 Years - Asia Dominates

- ✓ LNG has grown from an alternative energy source to one of the core energy sources
- ✓ Numbers of exporters and importers have grown significantly
- ✓ Although Europe gained much in the last two years, **Asia dominates - firstly Japan and Korea, recently China, India, and Southeast and South Asia**



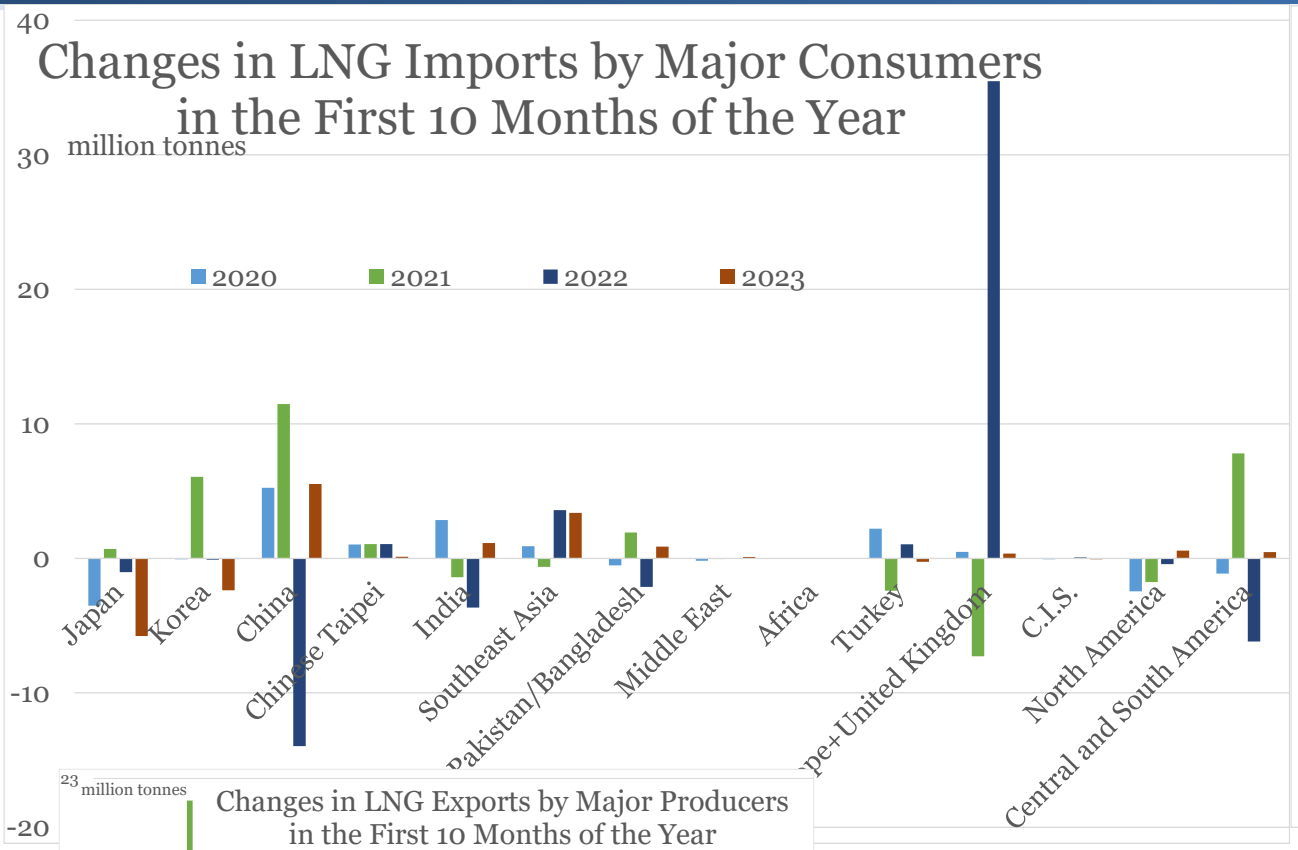
The Rapid Rise in Value of the LNG Market

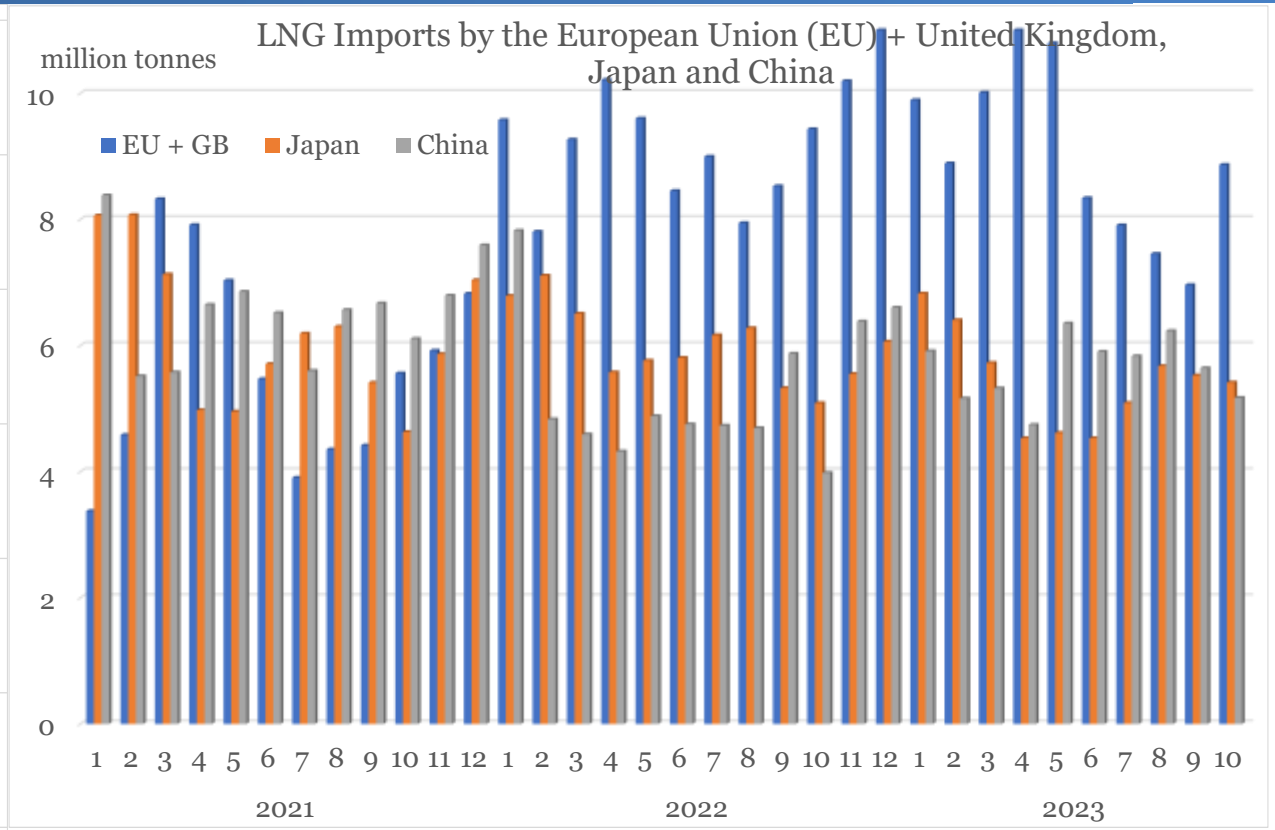
- ✓ The LNG market experienced a steady growth in the volume wise in 2022
- ✓ **The paid amount doubled in 2022,** in a stark contrast against 2020 when the amount decreased significantly
- ✓ The economic value of the market is expected to shrink in 2023 due to lower LNG prices

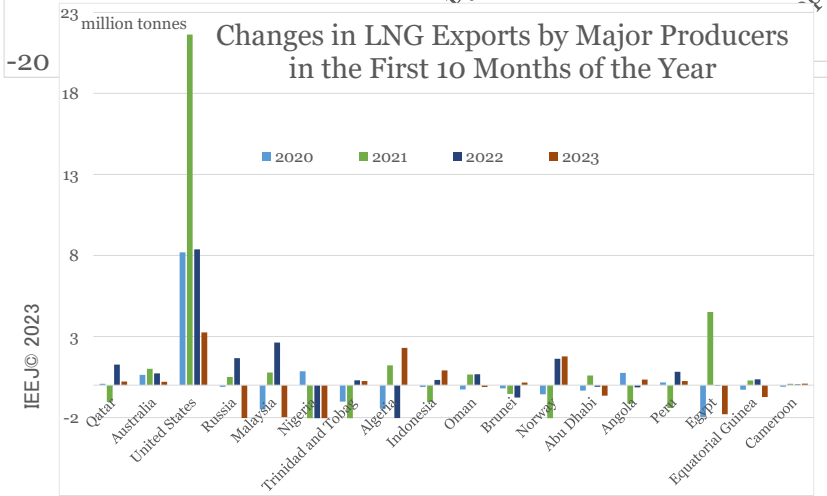


Source: based on data of GIIGNL, Global Trade Atlas, Trade Statistics, and ICE

Changes in LNG Imports in Major Consuming Countries and Regions

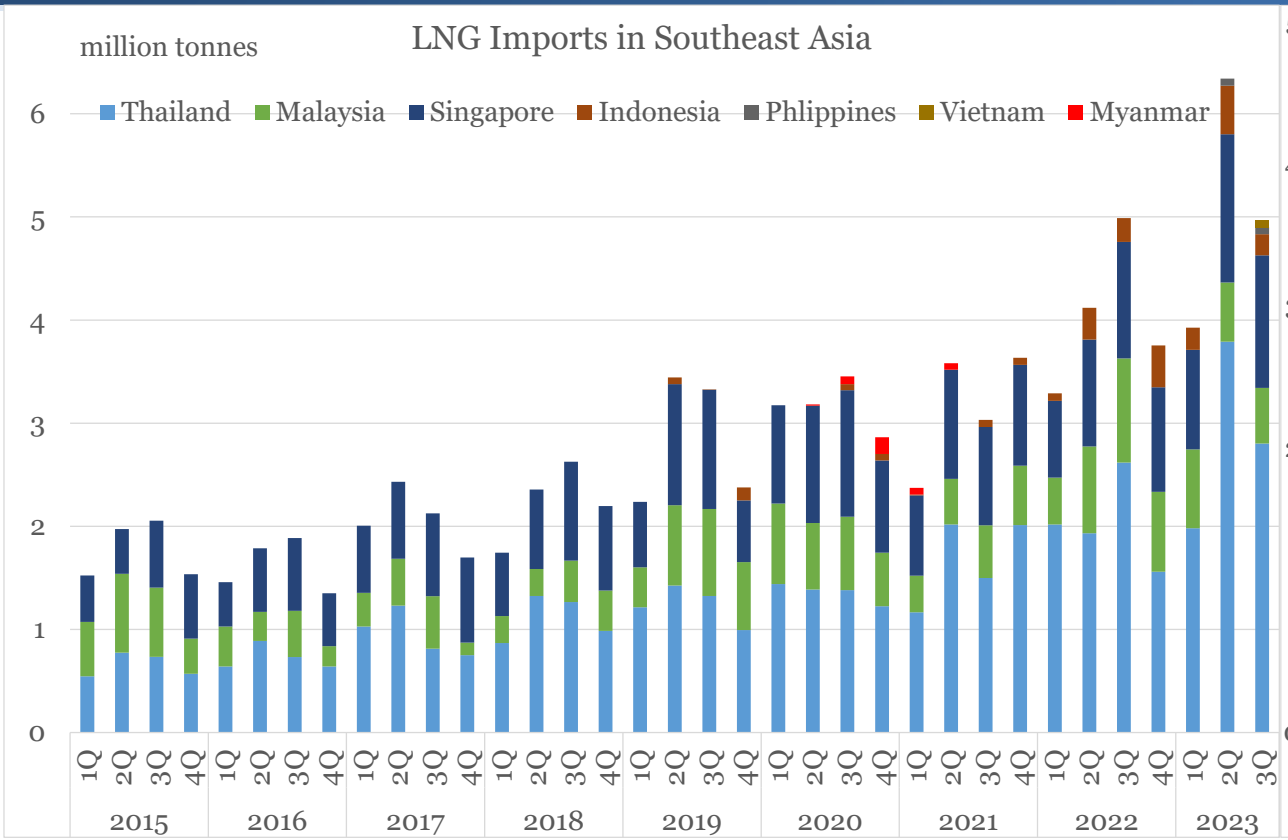


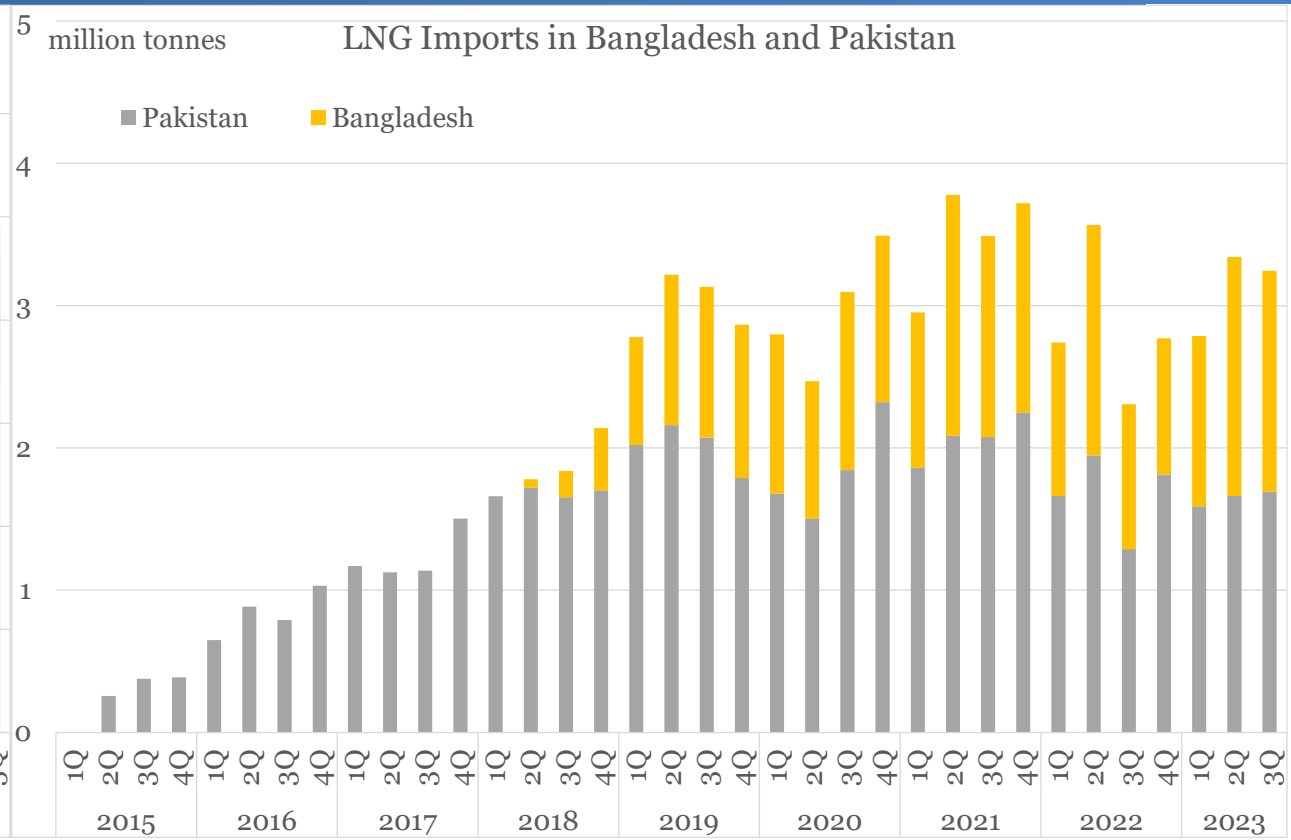




- ✓ Changes (y-o-y) in LNG imports have been modest in 2023
- ✓ The world traded a little over 200 million tonnes of LNG during the first half of 2023, and 326 million tonnes in ten months (+1%)
- ✓ **Europe (EU+GB) imports more LNG than Japan or China from 2022**
- ✓ In 2023, Japan decreased LNG imports
- ✓ China turned to positive growth in March, while Europe slowed its pace of increase with higher gas storage inventories

Changes in LNG Imports in Southeast and South Asia - Mixed Profiles





- ✓ Southeast Asia increased LNG imports by 20% or 2.5 million tonnes while Pakistan and Bangladesh combined decreased LNG imports by 18% or 2.5 million tonnes in 2022
- ✓ Southeast Asia has LNG exporters and importers, as well as prospective importers
- ✓ The Philippines, Hong Kong and Vietnam have imported their respective first LNG cargoes
- ✓ Bangladesh and Pakistan reduced LNG imports significantly in 2022, before showing some signs to resume more LNG imports in 2023

(Source) based on customs statistics and data of Cedigaz LNG Service

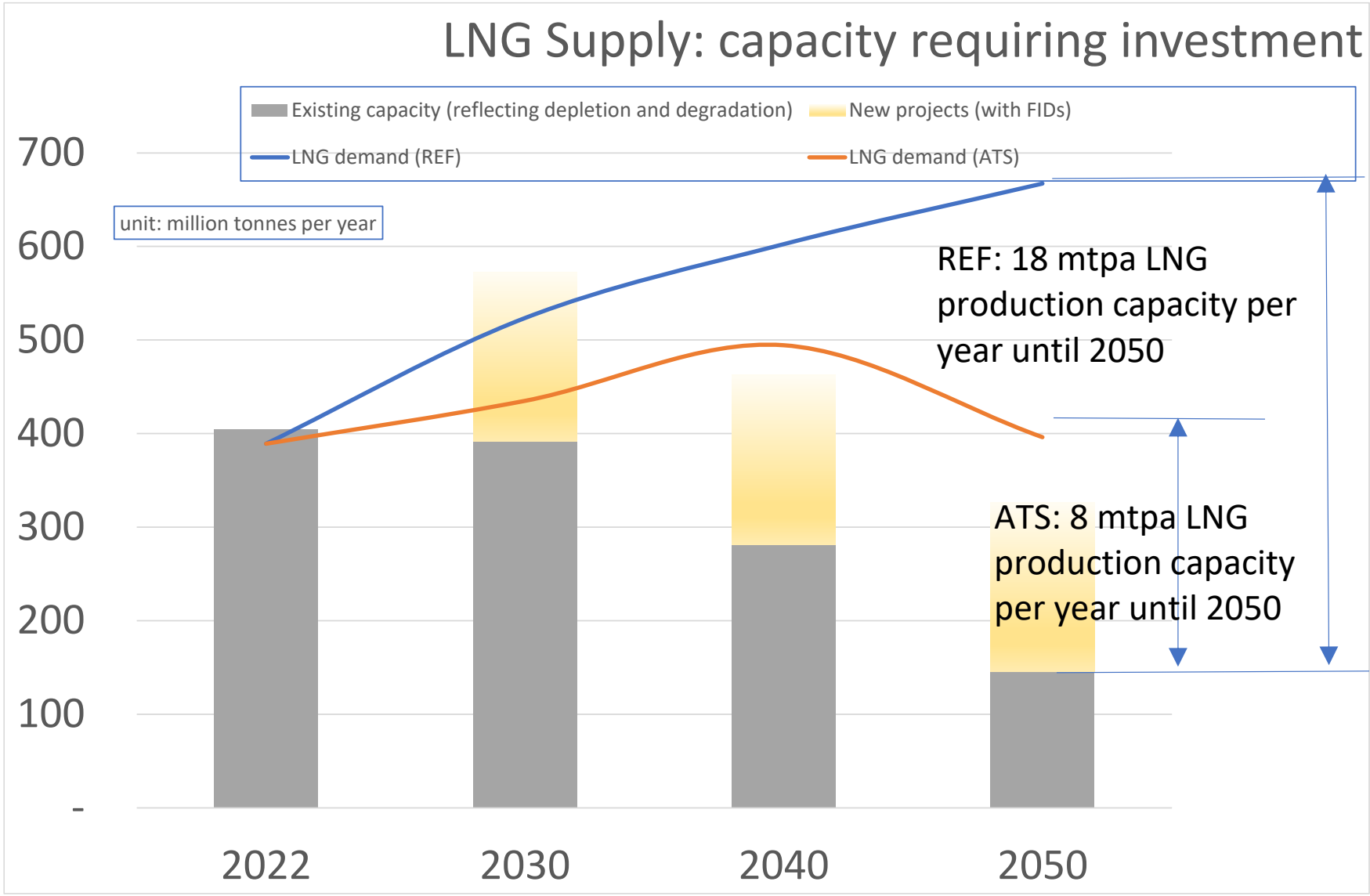
Investment in LNG Is Needed, To Meet Demand and Fill Gaps

Investment is needed in LNG production capacity until 2050 (and thereafter)

Required additional capacity investment means the gap between projected LNG demand and decreasing existing production capacity, to be filled by the followings:

1. Greenfield project investment
2. Alternative new field development (backfill) investment
   (the yellow stack indicates already sanctioned projects)
3. Investment in existing fields to offset production decline
4. Rejuvenation of existing liquefaction facilities

✓ *Those projects already greenlighted (included in the yellow stacks) may entails uncertainty with possible delays and failures to materialise



(Source) IEEJ Outlook 2024, October 2023

Trends of LNG Production Projects - Active and Costlier

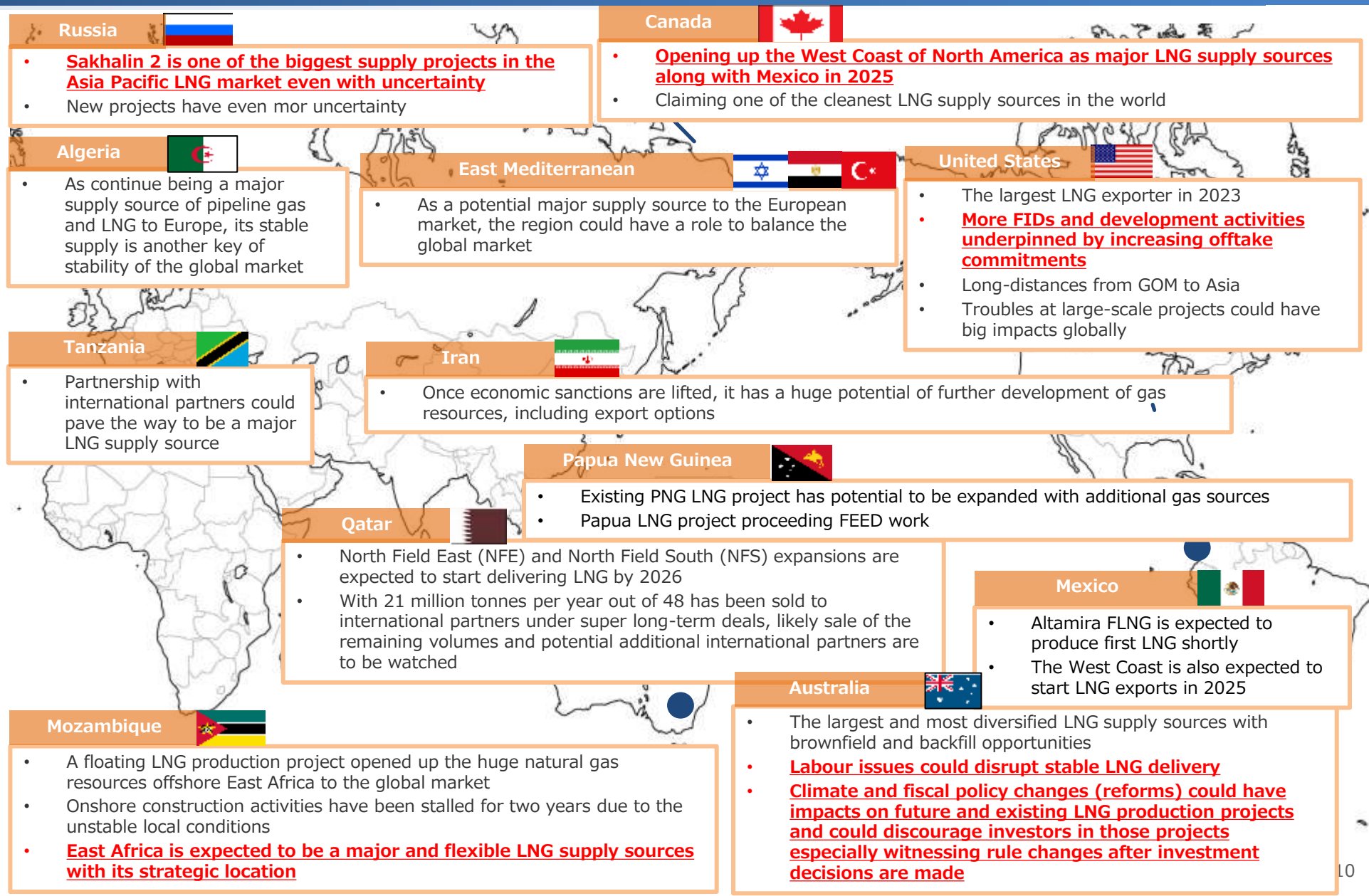
	Major trends	Factors to promote projects and cost reductions
2010-2014	• Responding to Northeast Asian LNG demand surge, **Australian LNG production projects proliferated**, leading to concentration of construction activities and cost escalarions	• Cost escalations in Australia stimulated LNG production development activities in other regions
2015-2020	• LNG production project development **activities shifted to the United States** with moderated cost escalations in both upstream and liquefaction sectors • As feedgas supply for the U.S. LNG shares the same network as the U.S. gas consuming market, the gas is not necessarily cheap but is expected to be stable on the long-term basis	• **Conversion of LNG receiving infrastructure** into LNG export facilities is a factor leading to overall cost reductions in the United States • Separated gas production and transportation sectoris n the United States have led to lower risks and costs for individual players • **Floating liquefaction (FLNG)** has become a competitive options to develop remote gas sources
2021-2023	• Logistical constraints caused by the pandemic **delayed construction acrtiviities**, leading to cost overruns • The Russia-Ukraine war has led to general cost escalations • Instability in those countries where LNG production projects have been already approved has caused delays	• Innovative small and mid-scale liquefaction applications bring cost reductions • **Modular and design-one-and-build-many** strategies lead to cost reductions • The phasing out from Russian gas has stimulated LNG production development activities in other regions
	• Prices of steel, concrete, and other materials are on the rise (as well as an end of zero-interest) • CCS and electrification (renewables) add costs	• LNG production developers competing for market windows in the late 2020s pursue cost reductions

Securing Greener LNG Production Projects - A Trend With Challenges

	Electrification and greener power sources	CCS
General Trends	• Electrification of liquefaction processes • Higher reliability and lower maintenance costs • More efficient liquefaction, better GHG management, and less gas consumption	• Capturing CO2 native to feedgas and generated from compression and liquefaction processes • Integrating CO2 captured in neighbouring industrial facilities could enhance economics
Challenges	• Securing greener power sources • Securing baseload and backup power supply • Installing renewable power sources within vicinity of the LNG production site • Securing flexibility in load and supply management of renewable power, with neighbouring industrial facilities, if there are any • Likely larger initial investment amount	• Securing suitable carbon storage sites in the neighbourhood • Creating sizable CO2 demand sources • Likely larger initial investment amount • Required time for integrating existing LNG facilities • Ensuring stable operation of the CCS • Greater technical challenges to capture CO2 from the process than from feedgas
U.S. Gulf Region	• Gradual progress has been observed in electrification with greener power sources partly as measures to reduce air pollutions	• CCS projects are developed by LNG production project developers partly helped by preferential tax treatment
Canada's West Coast	• Utilization of hydro-power from the grid	
Qatar	• In parallel with the NFE and NFS expansion projects solar power sources are developed	• CCS plans are combined with the NFE and NFS • A jetty boil-off gas recovery facility recovers BOG and reliquefy BOG

Major Current and Future LNG Supply Sources

- ✓Projects advance around the world to increase LNG supply
- ✓Risks are here and there with development
- ✓Projects become more difficult in frontier areas as relatively accessible ones have been already developed
- ✓Expansion at existing sites (brownfield) and feedgas supply replacement projects (backfill) are considered economically advantageous



Russia
- **Sakhalin 2 is one of the biggest supply projects in the Asia Pacific LNG market even with uncertainty**
- New projects have even mor uncertainty

Canada
- **Opening up the West Coast of North America as major LNG supply sources along with Mexico in 2025**
- Claiming one of the cleanest LNG supply sources in the world

Algeria
- As continue being a major supply source of pipeline gas and LNG to Europe, its stable supply is another key of stability of the global market

East Mediterranean
- As a potential major supply source to the European market, the region could have a role to balance the global market

United States
- The largest LNG exporter in 2023
- **More FIDs and development activities underpinned by increasing offtake commitments**
- Long-distances from GOM to Asia
- Troubles at large-scale projects could have big impacts globally

Tanzania
- Partnership with international partners could pave the way to be a major LNG supply source

Iran
- Once economic sanctions are lifted, it has a huge potential of further development of gas resources, including export options

Papua New Guinea
- Existing PNG LNG project has potential to be expanded with additional gas sources
- Papua LNG project proceeding FEED work

Qatar
- North Field East (NFE) and North Field South (NFS) expansions are expected to start delivering LNG by 2026
- With 21 million tonnes per year out of 48 has been sold to international partners under super long-term deals, likely sale of the remaining volumes and potential additional international partners are to be watched

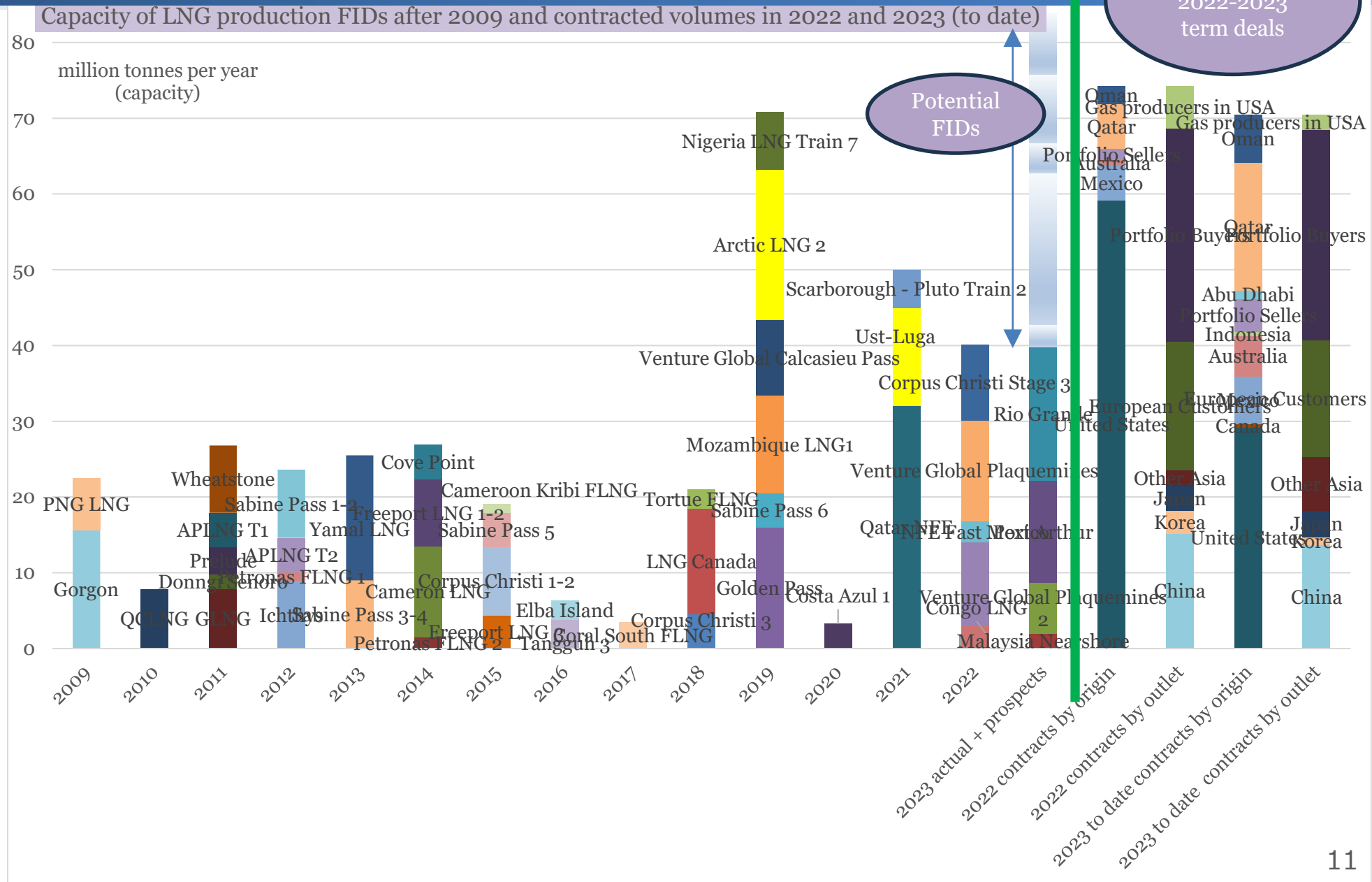
Mexico
- Altamira FLNG is expected to produce first LNG shortly
- The West Coast is also expected to start LNG exports in 2025

Australia
- The largest and most diversified LNG supply sources with brownfield and backfill opportunities
- **Labour issues could disrupt stable LNG delivery**
- **Climate and fiscal policy changes (reforms) could have impacts on future and existing LNG production projects and could discourage investors in those projects especially witnessing rule changes after investment decisions are made**

Mozambique
- A floating LNG production project opened up the huge natural gas resources offshore East Africa to the global market
- Onshore construction activities have been stalled for two years due to the unstable local conditions
- **East Africa is expected to be a major and flexible LNG supply sources with its strategic location**

LNG Production Investment and Term Contracts Are On The Rise

- ✓LNG FIDs and construction activities are on the rise after the Ukraine war
- ✓Russian projects, even though they have been with FIDs are uncertain
- ✓**The United States as supply sources, China, other Asia, Europe, and portfolio players as buyers represent majority of term-contract parties in 2022 and 2023**



Japanese LNG Procurement Tends to Rely on Partnerships and Portfolio Players

- ✓ Volumes procured so far go down from 60 million tonnes of 2025 to 50 million tonnes by 2030
- ✓ Requirement is expected to maintain the 60 million tonnes per year level until 2050 according to the IEEJ's Reference Scenario
- ✓ For future procurement:
  - ➢ Large volumes under long-term contracts are difficult for individual buyers
  - ➢ Share of short-term and spot procurement grows

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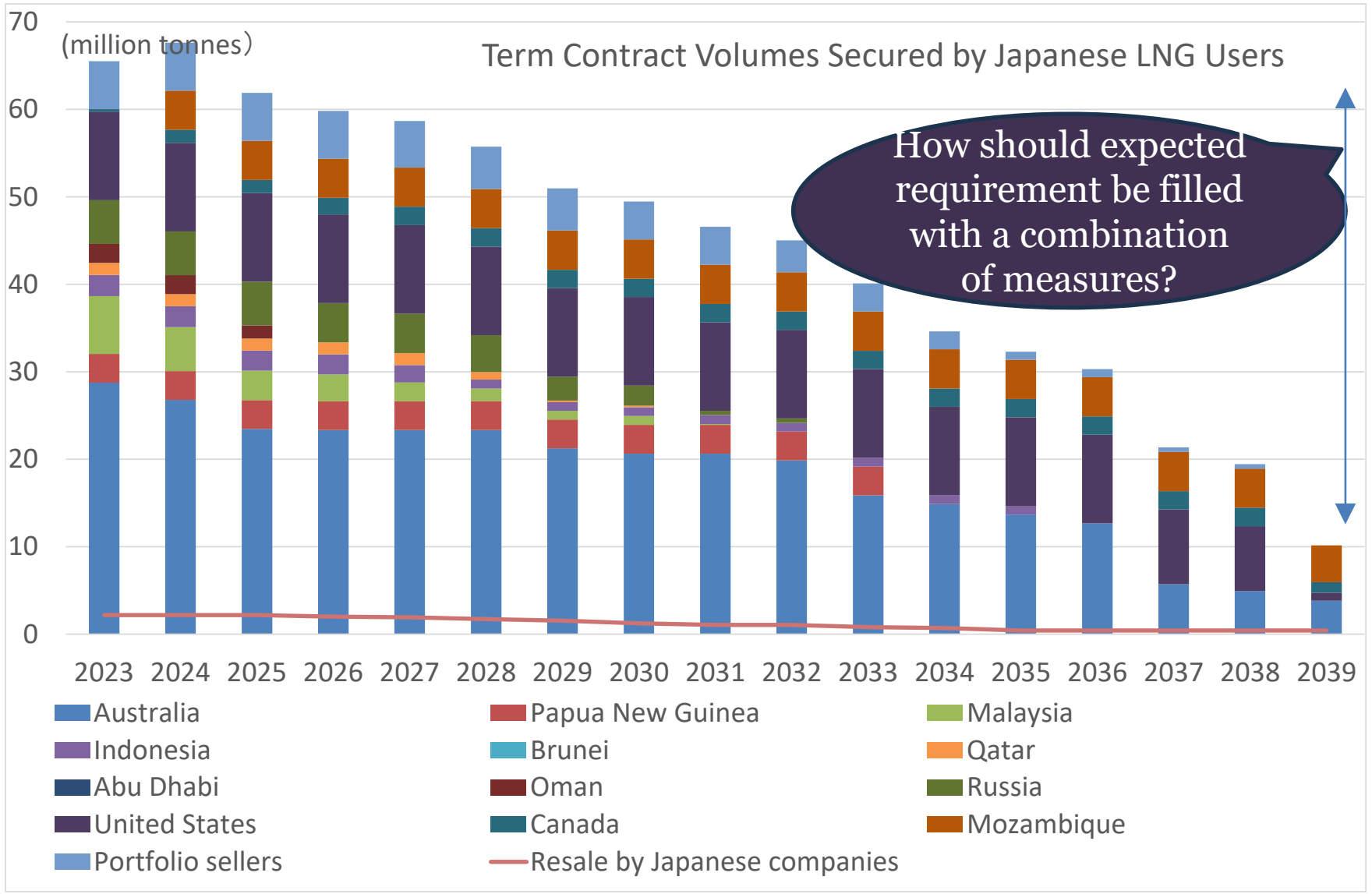
- ✓ Cooperation between companies and the government and policy supports are essential
  - ➢ Procurement from portfolio players of Japan and other international portfolio players
  - ➢ Encouragement for Japanese larger buyers and trading houses to undertake portfolio activities
  - ➢ Partnerships with international companies, including joint procurement and optimization
  - ➢ Partnerships between fellow companies – including joint purchase



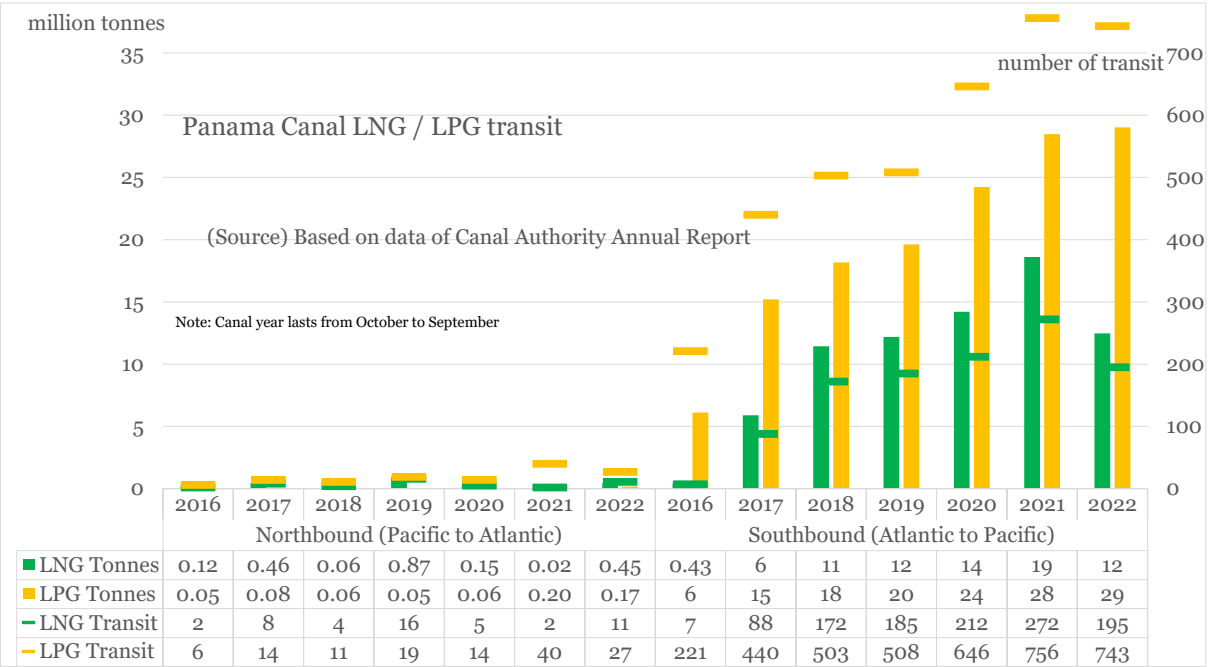
Huge Benefit of the Panama Canal - As Well As Bottlenecks

<Benefit of the expanded canal>

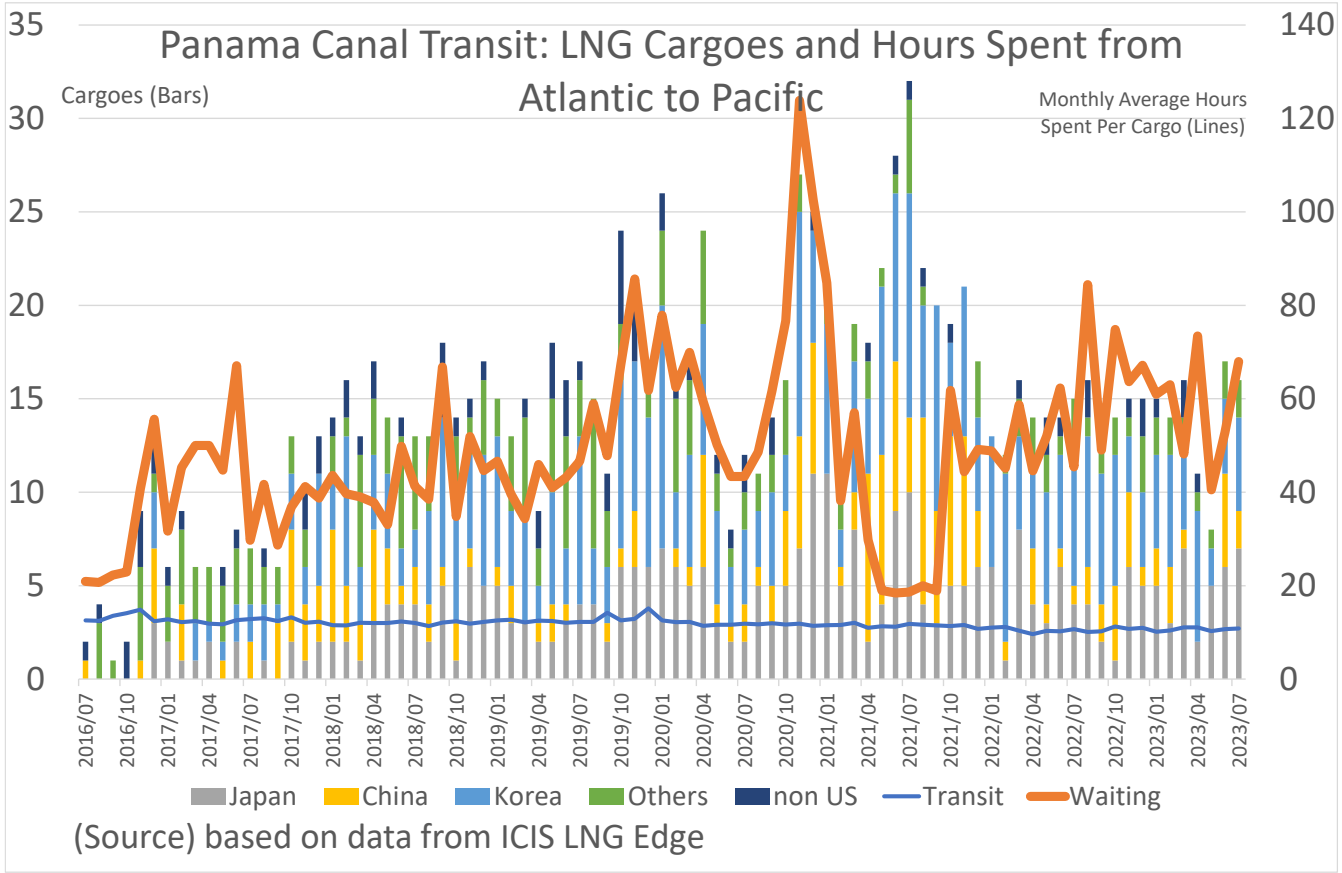
- ✓As 2016 expansion of the Panama Canal enabled transit of LNG carriers, more LNG can be transported from the United States mostly the Gulf of Mexico to Northeast Asia
- ✓Thanks to the shale revolution, more LLPG is also transported through the canal

<challenges>

- ✓Due to larger volumes transported, waiting times are longer to transit
- ✓Drought lowers water levels leading to restrictions of number of large vessels to transit

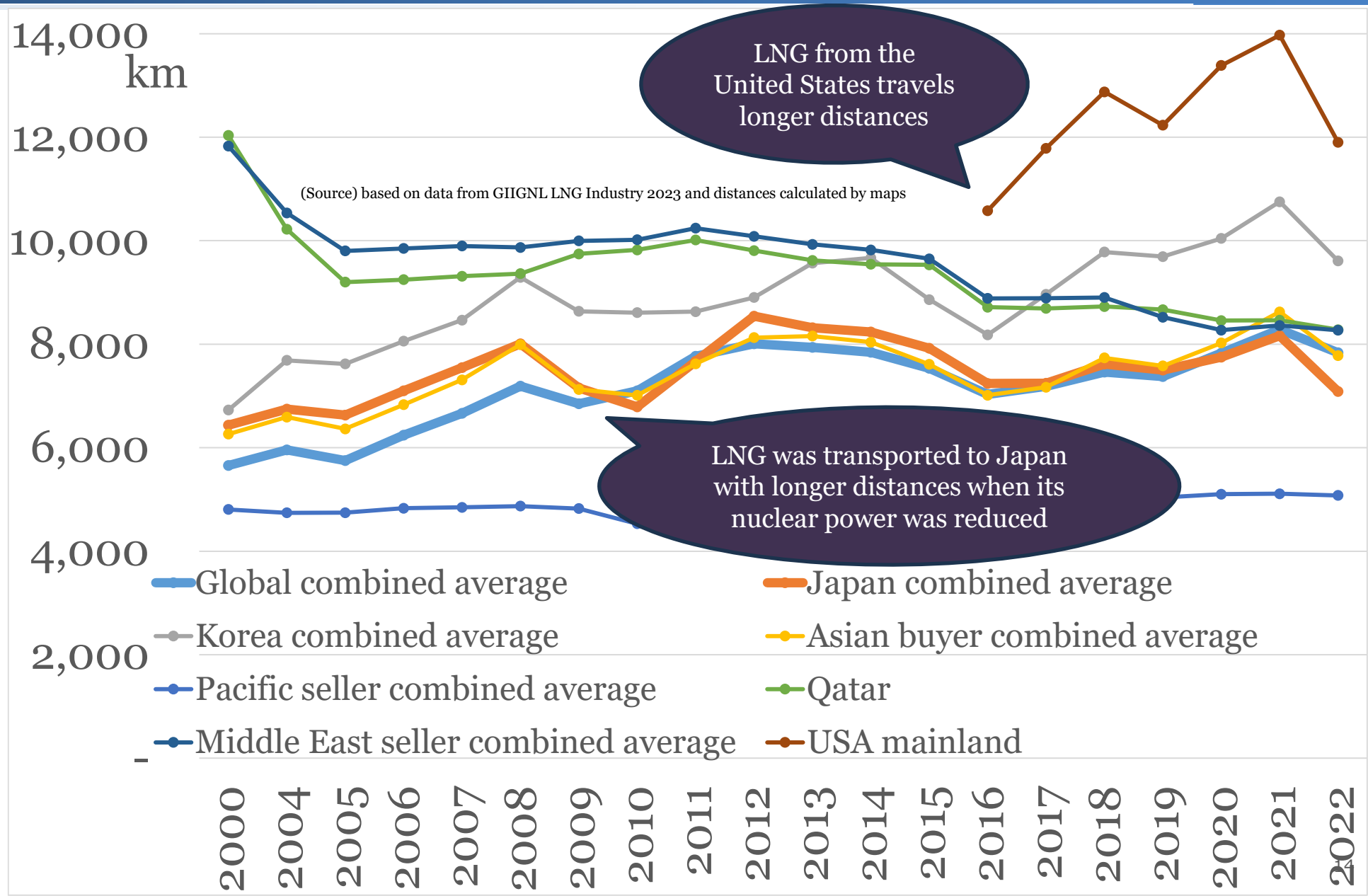


	2016	2017	2018	2019	2020	2021	2022	2016	2017	2018	2019	2020	2021	2022
LNG Tonnes	0.12	0.46	0.06	0.87	0.15	0.02	0.45	0.43	6	11	12	14	19	12
LPG Tonnes	0.05	0.08	0.06	0.05	0.06	0.20	0.17	6	15	18	20	24	28	29
LNG Transit	2	8	4	16	5	2	11	7	88	172	185	212	272	195
LPG Transit	6	14	11	19	14	40	27	221	440	503	508	646	756	743



Longer Transportation Distances and Bottlenecks Make Optimization Essential

- ✓ Along with supply sources, transportation routes and distances are diversified
- ✓ Distances have been longer when LNG demand surged in Japan and Asia unexpectedly
- ✓ Long-distance transportation has increased notably from the U.S. Gulf Coast to Northeast Asia
- ✓ In 2022, the shift of U.S. LNG to Europe lowered the overall average transportation distance
- ✓ The West Coast of North America and East Africa are expected to contribute to optimization of LNG transportation



G7 Ministerial Communique Underwrites Importance of Natural Gas

Relevant articles related to LNG and natural gas	Note
49. Energy security and clean energy transitions: . . . commitment. . . to accelerate the **phase-out of unabated fossil fuels**	Definition of "abated" will be the key
61. Methane: . . . **an internationally aligned approach for measurement, monitoring, reporting, and verification of methane and other GHG** emissions to create an international market that minimizes GHG emissions across oil, gas, and coal value chains, including by minimizing flaring and venting, and adopting best available leak detection and repair solutions and standards.	International standards of emission measurement and international cooperation are important
69. Natural gas and LNG . . . **investment in the gas sector can be appropriate** to help address potential market shortfalls provoked by the crisis, subject to clearly defined national circumstances, and **if implemented in a manner consistent with our climate objectives** and without creating lock-in effects, for example by ensuring that projects are integrated into national strategies for the development of low-carbon and renewable hydrogen.	Great recognition of the importance of natural gas and LNG Also important is to establish the standard of transition compatible LNG

IEA's Role for Security of Supply: Gaining Momentum

	Oil	Natural Gas / LNG
Stockpiling	Obliging member countries to hold 90 days of net imports	Extensively discussed in the past; no mechanism
Demand control	Obliging member countries to prepare demand restraint measures	Extensively discussed in the past; no mechanism
Emergency response	Activation and deactivation on collective stock release and/or oil sharing	No official mechanism; bi-annual and ad-hoc ministerial meetings; statements and recommendations
Data collection	Demand, supply, import/export, stocks, and price (+JODI)	Demand, supply, import/export, stocks, and price (+JODI-Gas)
Research	Market and policy analysis and recommendation	Market and policy analysis and recommendation
	Oil Market Report (monthly with quarterly data)	Gas Market Report (quarterly, including annual Global Gas Security Review from 2017)
Cooperation with non-IEA	Association programme for China, India, and others	Association programme as same as that for oil
	Consultation with OPEC	Consultation with some gas producing countries and companies

Toward Long-Term Stability and Further Growth of the LNG Markets

	Notable issues to be considered from the perspective of LNG consumers
Supply issues	**Momentum is build - Stronger support is desirable** Steady realisation of LNG projects in the United States as the mainstay supply sources Stability and potential expansion of LNG production in Australia, Canada and Mexico Realization of LNG production projects in Africa's frontier regions Effective utilisation of existing - amortised - LNG production projects in enhancing flexibility
Demand issues	As LNG demand centres shift to developing economies, **support from traditional LNG consuming countries** may be effective As flexibility in the LNG market is valued, efforts are needed between the public and private sectors to secure stable demand and enable **some forms of long-term commitments**. Demand aggregation, utilization of portfolio players and joint procurement are necessary
Pricing issues	Increasingly greater fluctuation of prices due to increasing volatility and increasing gas-on-gas pricing make it important to consider **appropriate balances between different pricing arrangements**
Climate change challenges	**Clarification of LNG project standards** that are compatible with energy transition (methane and GHG emission mitigation measures) is necessary Promoting CC(U)S and green electricity in LNG liquefaction contributes to greening LNG
Financial challenges	**Financing arrangements that can accommodate shorter LNG sale contracts** are needed for **both matured and emerging markets in the Asia Pacific region** As the market expands, it is also important to ensure the creditworthiness of new buyers entering the market