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Outlook for the International Gas Market

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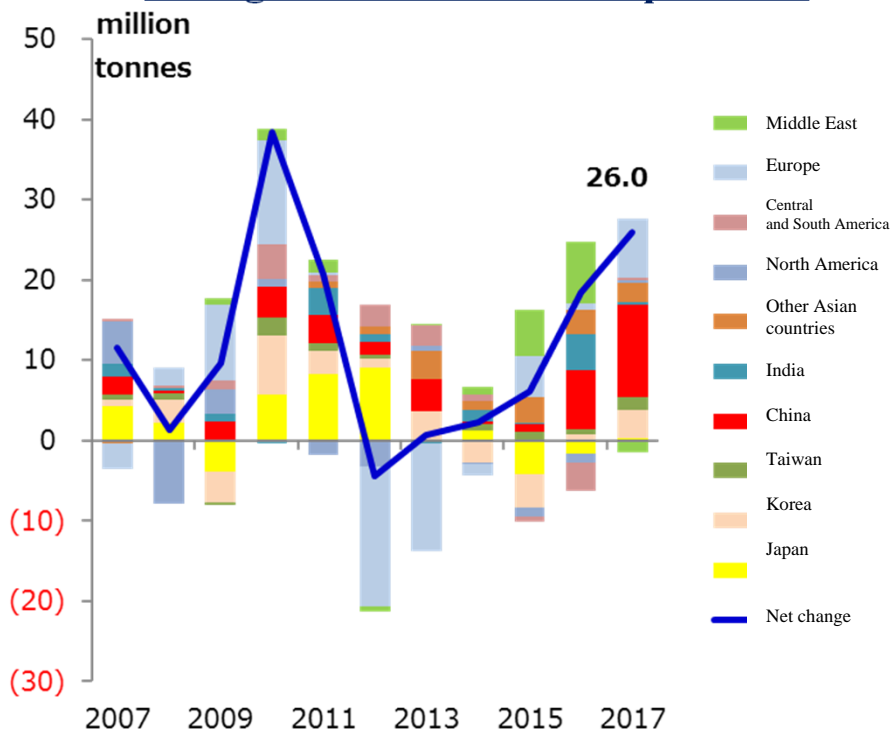
Key Points of this Report

1. The global LNG market up to 2019 will continue to see loose supply-demand conditions. However, the current loose conditions will move toward a rebalancing, and there is rising interest in the timing of when the market will shift to tight conditions
2. Global LNG demand will continue to increase going forward. Growth in China's LNG demand will retreat compared to 2017, but remain at elevated levels.
3. On the supply side, a number of new projects will commence operations mainly in the United States and Australia. In addition, there is growing momentum behind FID for new projects in the future, reflecting rising crude oil and LNG prices as well as robust demand for LNG in emerging countries.

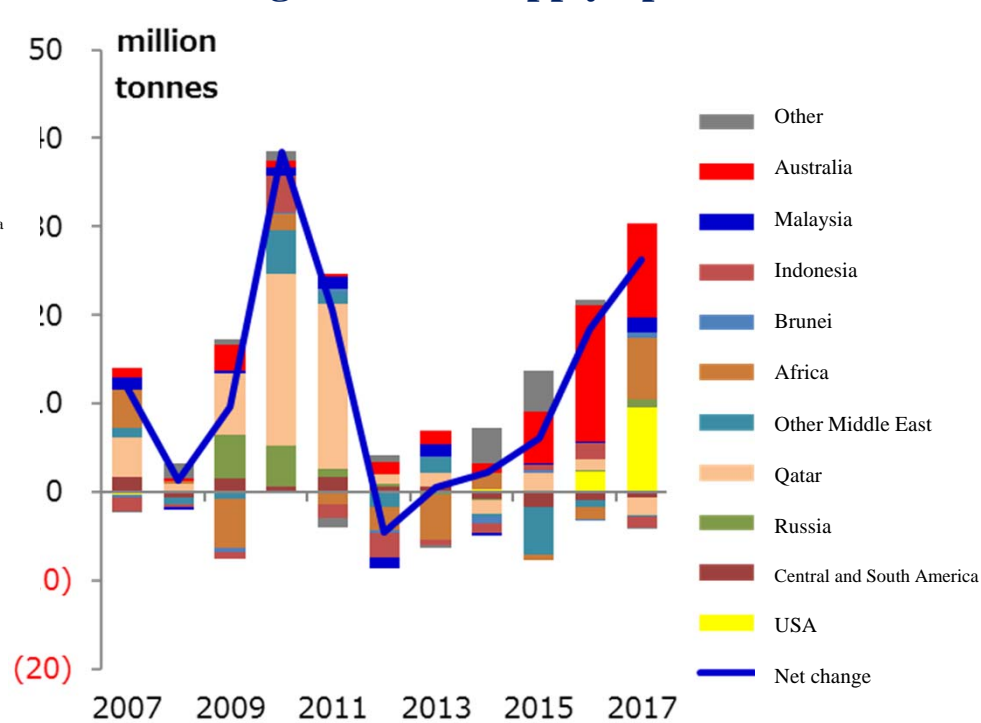
LNG Market in 2017

- The global LNG market is expanding at a high rate of speed (‘second natural gas revolution’ ©IEA).
- On the demand side, China saw robust growth of 42% year on year, while the overall growth of demand in other emerging countries was just 2.5% year on year.
- On the supply side, there were significant increases in Australia and the United States. Supply from Africa also rebounded.
- Stable production continues in the Middle East despite growing geopolitical risks.

Changes in LNG demand up to 2017



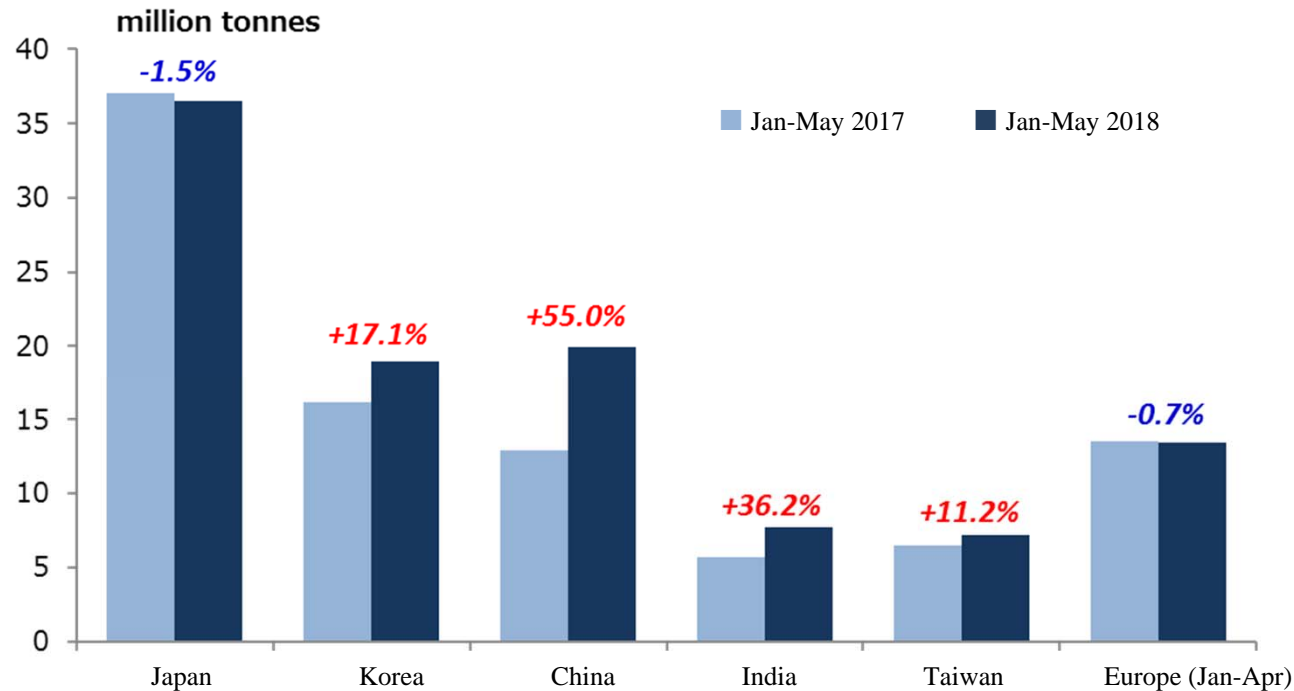
Changes in LNG supply up to 2017



Imports in Major LNG Importing Countries since the Start of 2018

- China continues to see consistently high growth, as imports in the January-to-May period of 2018 jumped 55% over the previous year
- India, which saw only slight increases in demand in 2017, recorded a recovery in demand growth as of the January-to-May period.
- Japan's imports are declining amid the restart of operations at nuclear power plants, but demand in Korea and Taiwan as of the January-to-May period was up year on year following an increase in demand for power generation.
- Europe's LNG demand declined slightly year on year in the January-to-April period caused by weather factors and an increase in Russian gas imports.

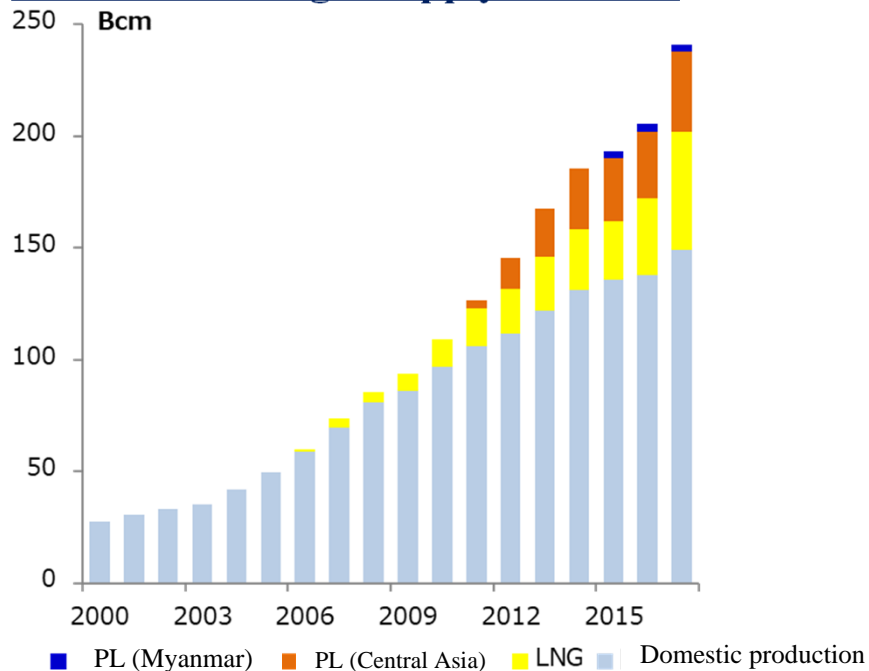
Imports in major LNG importing countries/regions since the start of 2018



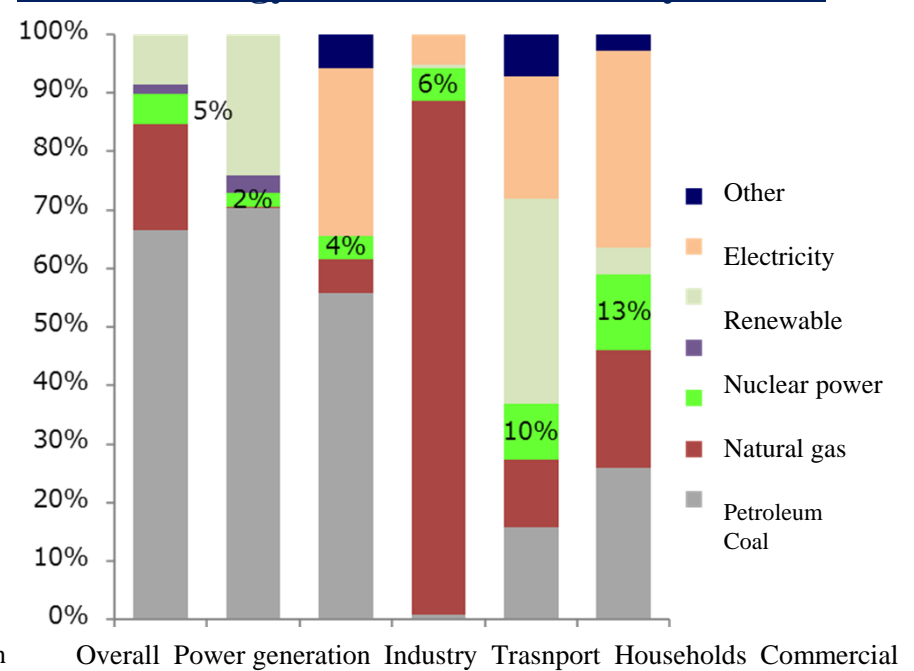
China's Natural Gas Supply-Demand

- The growth rate (+42%) of LNG demand in 2017 far outstripped increases in demand for natural gas overall (+17%).
 - Gas demand has grown at consistently high levels since the 2000s, but growth in 2017 was particularly high.
 - While China continues to boost production of gas, it cannot keep pace with growing demand.
- Demand trends by sector
 - Demand has grown mainly for consumer use, while use for power generation and by industry remains relatively small.

China's natural gas supply structure



China's energy demand structure by sector*



*2015 actual results based on generated output of the electric power sector

Source: BP, IEA

Reasons for Sharp Increase in Demand in 2017

- Growing energy demand overall driven by sustained economic growth
 - Economic growth rate in 2017 was 6.9%

- Measures by the Government of China to increase gas use
 - China has established a target for gas to account for a 10% share of the country's overall energy mix in 2020, and 15% in 2030.

- Measures by the Government of China against air pollution
 - The Government of China is implementing domestic measures against air pollution mainly focused on lowering PM2.5.
 - In particular, 2017 was the final year of the five-year target period of measures against air pollution that began in 2013. For this reason, situation similar to last minute demand to shift from coal materialized to reach this target.

- Holding of the National Congress of the Communist Party of China and economic stimulus
 - The National Congress, held once every five years, took place in 2017
 - The Government of China implemented aggressive economic stimulus to activate economic activities, which boosted energy demand.

China's Natural Gas Supply Infrastructure

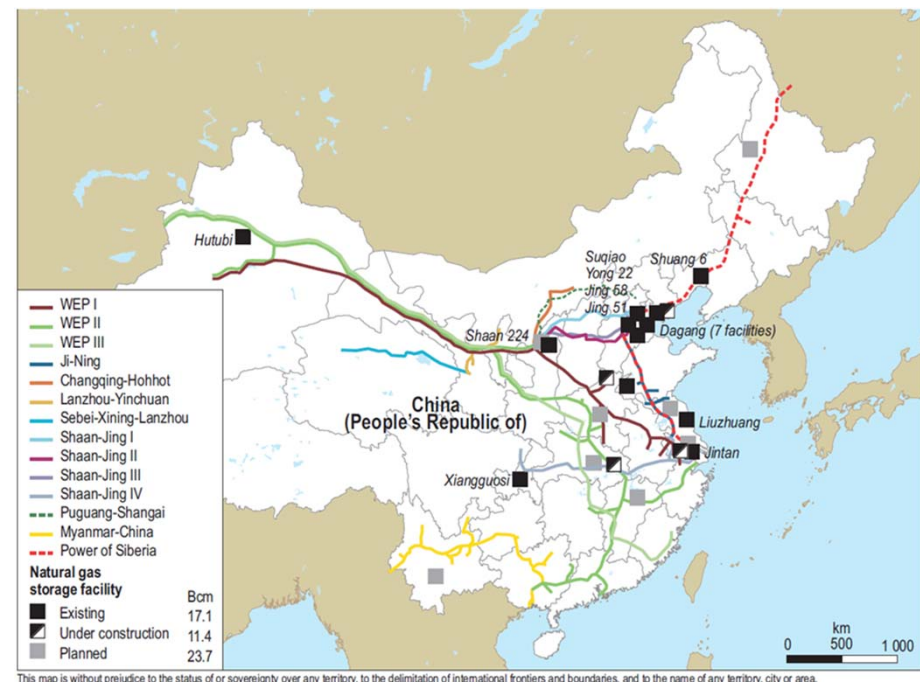
● Import capacity

- LNG receiving capacity stood at 55 million tons compared to LNG imports of 39 million tons in 2017. New receiving terminals will commence operations in 2018, which will ensure sufficient capacity for rising imports.
- The capacity of import pipelines from Central Asia is 55bcm and from Myanmar 12bcm. Actual imports in 2017 totaled 36bcm and 3bcm, respectively.
- The Power of Siberia pipeline from Russia is planned to begin operations at the end of 2019.

● Seasonal fluctuations and measures against gas shortages

- Domestic natural gas storage capacity stands at 41.5Bcm at present. To absorb seasonal fluctuations, China continues to build underground storage facilities in the country.
- At the same time, progress is also being made on the development of pipelines connecting demand areas with storage facilities.
- On the demand side, China is diversifying supply sources and establishing approaches on procedures/information sharing with regard to stopping supply during tight market conditions.

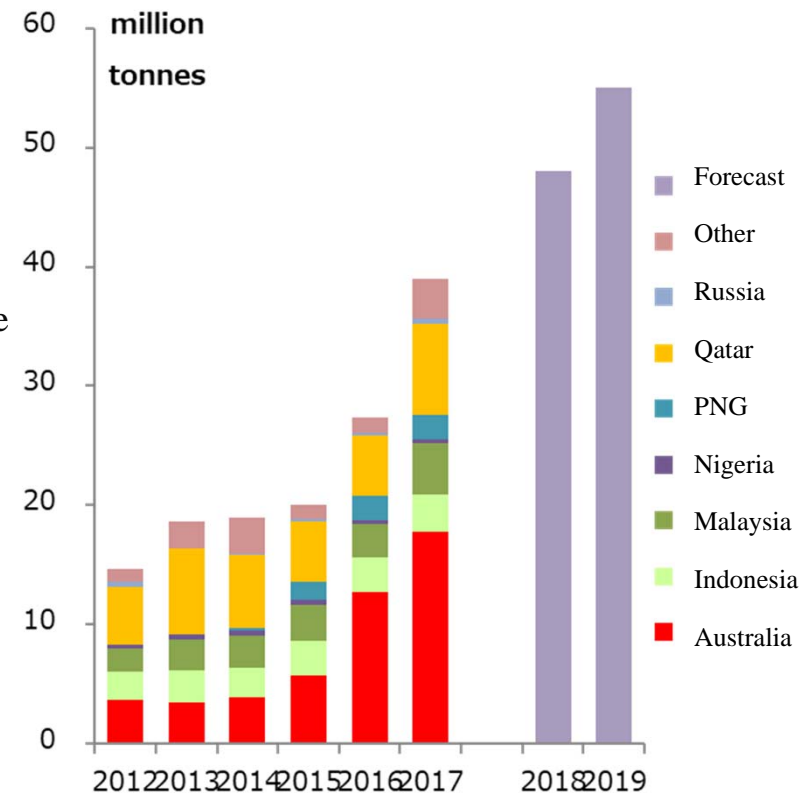
China's main natural gas supply infrastructure



Outlook on China's Future LNG Demand

- We forecast China's LNG demand (full-year) in 2018 will increase around 9 million tonnes over the year before to 48 million tonnes and in 2019 will increase a further 7 million tonnes to around 55 million tonnes.
 - Total natural gas demand up to 2019 will be 285bcm, while domestic production will increase up to 170bcm and P/L imports will remain at current levels.
- Factors behind the increase in LNG demand
 - Economic growth and rising energy demand
 - Government measures against air pollution will continue
 - China's target to increase gas use in the energy mix (share of 10%) by 2020 (China use of gas is still low).
 - Stagnant imports from pipelines
- Factors behind the slowdown in LNG demand
 - No policy factors for gas demand as with 2017
 - Potential for US-China trade tension to worsen and macroeconomic slowdown.
 - Effects to curtail demand following rising prices
 - Delays in pipeline development for small customers

China's LNG demand

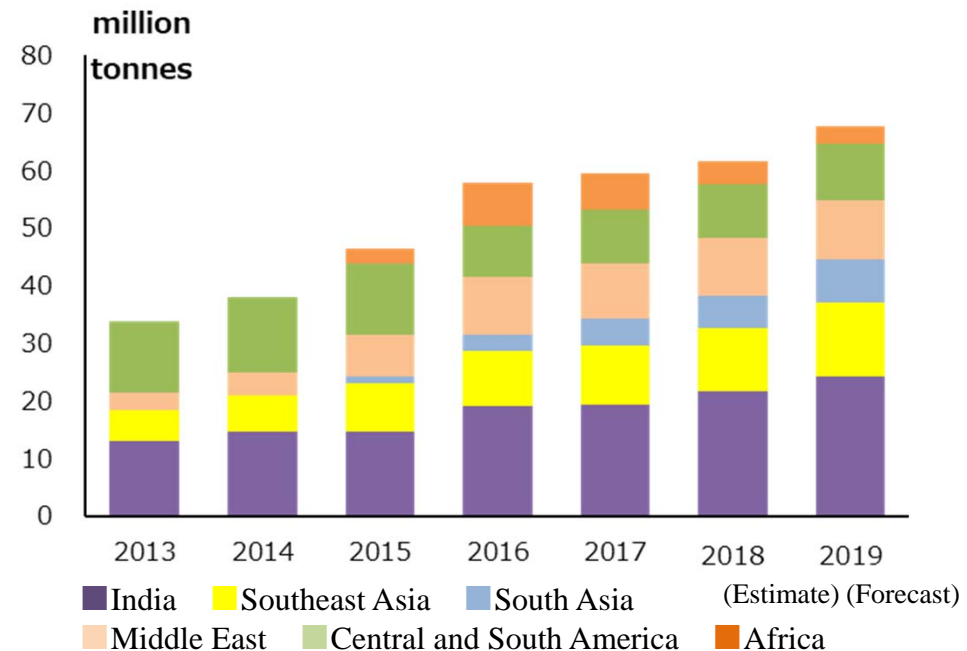


Source: Institute of Energy Economics, Japan

Demand Trends in Other Emerging Countries

- LNG demand in other emerging countries (Asia, Middle East, Latin America, and Africa) in 2017 increased just 1.5 million tons over the previous year.
- Rising prices are one of the biggest factors slowing demand.
 - Rising LNG prices vs. regulated energy prices domestically
 - In Egypt, imports declined amid an increase in domestic gas production.
- Looking ahead, demand is expected to expand gradually in South Asia, which is relatively less susceptible to price impacts and in India, which is developing new receiving terminals.

LNG demand* in emerging countries (ex-China)



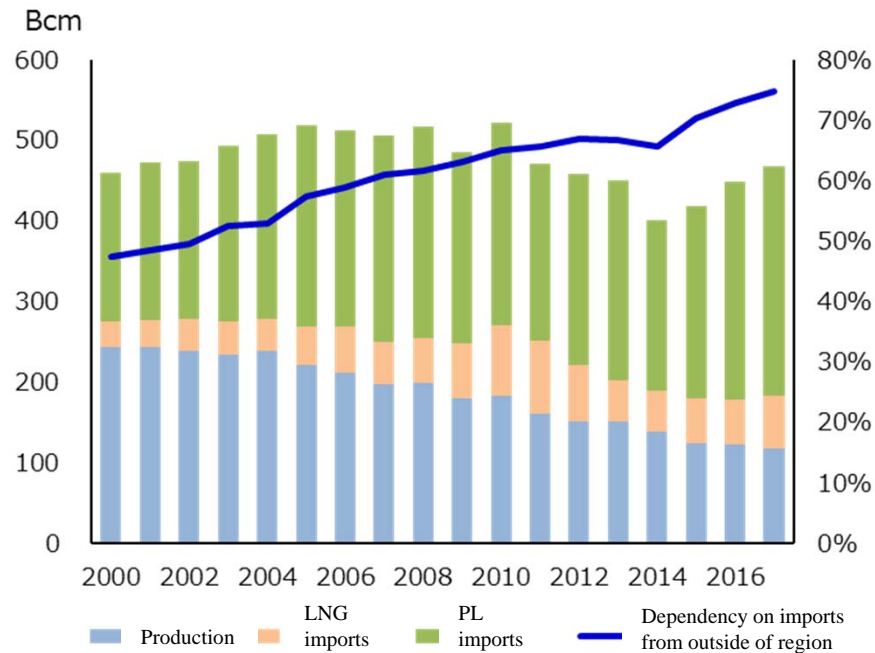
*Figures after 2017 are forecasts

Source: GIIGNL, Institute of Energy Economics, Japan

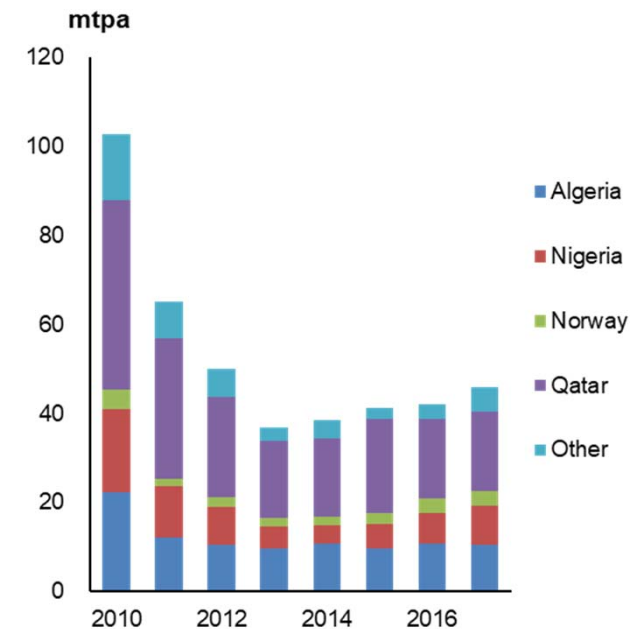
Europe's Natural Gas/LNG Supply-Demand

- Over the past several years gas production is declining within Europe, but gas demand is rising. As a result, imports have risen sharply.
 - In 2018, dependence on imports will increase further as Groningen of the Netherlands plans to cut production at gas fields, among other factors. In particular, the market share of Russian gas is expected to continue increasing.
 - LNG imports, too, will continue increasing. Europe is the only region in the world accepting surplus LNG. With United States LNG exports ramping up, Europe's LNG imports should trend higher.
 - + Interest is growing in the EU about LNG as a way to reduce dependence on pipeline imports.

Europe's natural gas supply-demand



Europe's LNG imports

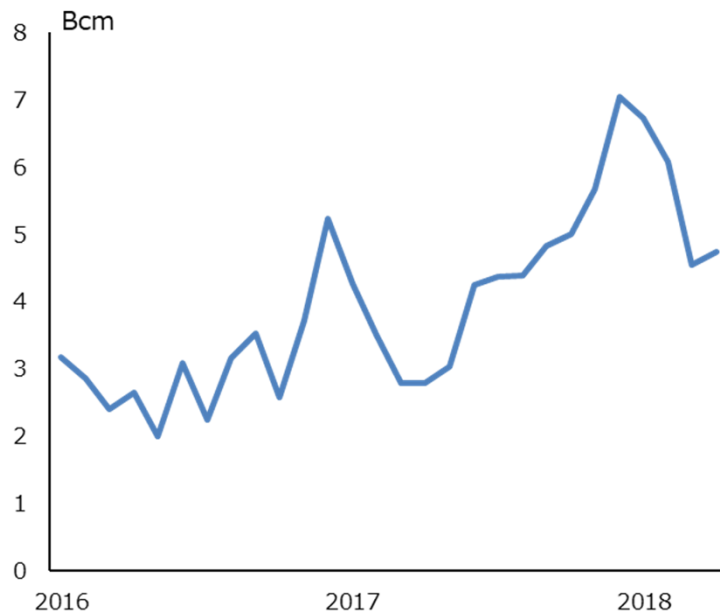


Source: BP, GIIGNL

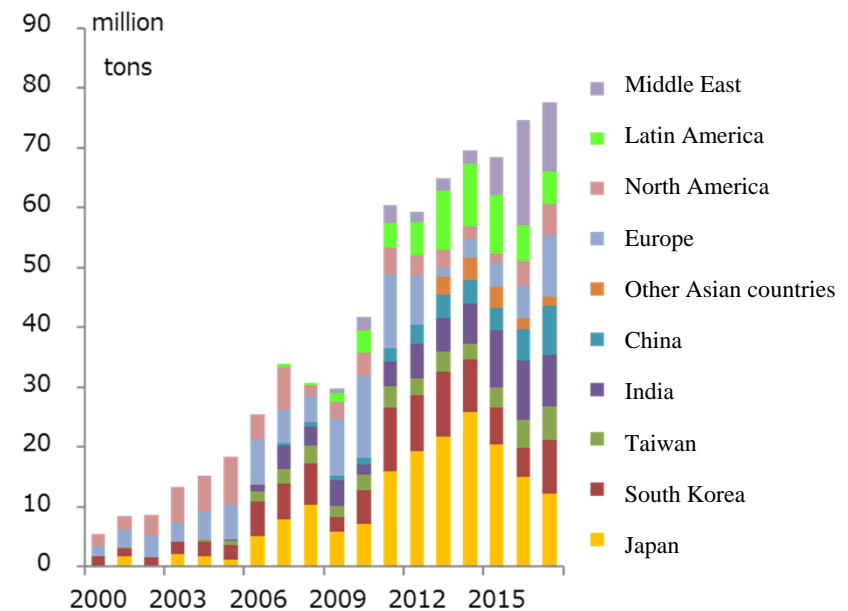
Seasonal Fluctuations in LNG Import Demand

- Seasonal fluctuations have grown larger amid the growing size of the LNG market.
 - In 2017, China's peak LNG imports were 2.4 times higher than the off-peak figure (monthly basis; 1.3 times higher than Japan).
 - Although the spot/short-term market continues to grow, they lack the ability to absorb rapid demand volatility.
- Price volatility remains a possibility again this winter due to the growing range of seasonal fluctuations.
 - China and others are examining measures against seasonal fluctuations (page 6), but time will be needed before effects are observed.
- There is an urgent need to create a spot market with high liquidity that can absorb to some extent seasonal fluctuations through the elimination of the destination clause, etc.

China's monthly LNG imports



Worldwide LNG spot short-term trading



Source: JODI-Gas, ICIS

Destination Restriction in Natural Gas Trade

- Study report released by the Fair Trade Commission (June 2017)
 - This report found that the destination clause in LNG contracts may violate the Anti-Monopoly Act. This report similarly found that the Take or Pay clause after investment recovery could pose a problem under the Anti-Monopoly Act.
 - Since then, domestic buyers have steadily eliminated destination restrictions in new contracts.
 - + New contracts in Malaysia, Mozambique, etc.

- In June 2018, EU's DG Competition announced it began investigating potential destination restriction LNG trade
 - The scope of this investigation was long-term contracts between Qatar and European buyers. The investigation plans to look into the presence of clauses that inhibit free trade within a region.
 - In recent years, the EU has shown greater interest in the potential of LNG as a way to reduce pipeline gas imports. Particularly, it has shown a strong interest in improving the flexibility of LNG trade.

Emergence of Floating LNG (FLNG)

- In 2017, Malaysia PFLNG became the first FLNG facility in the world to begin exporting.
- Looking ahead, construction or studies are underway on new FLNG in Australia and Africa, etc.
- FLNG is an effective technology for developing remote offshore gas fields, deepwater offshore gas fields, and medium- and small-sized gas fields, etc. FLNG offers a potential that could have a major effect on boosting future supply capacity.

Strengths and weaknesses of FLNG

Strengths

- Less local construction work because the float can be made in a shipyard
- Less time needed for environmental assessment because installation causes few impacts
- Can be relocated to a different gas field after completing production at another gas field
- Can reduce pipeline costs for the transport of raw gas because LNG can be produced close to offshore gas fields
- Can convert old LNG bulk carrier into FLNG, etc.

Weaknesses

- Affected by weather and sea conditions
- All facilities are located on the same structure, meaning a fire or other accident could result in massive losses
- Limited number of shipyards capable of building
- In principle, cannot expand capacity, etc.

Main FLNG facilities (including in planning stage)

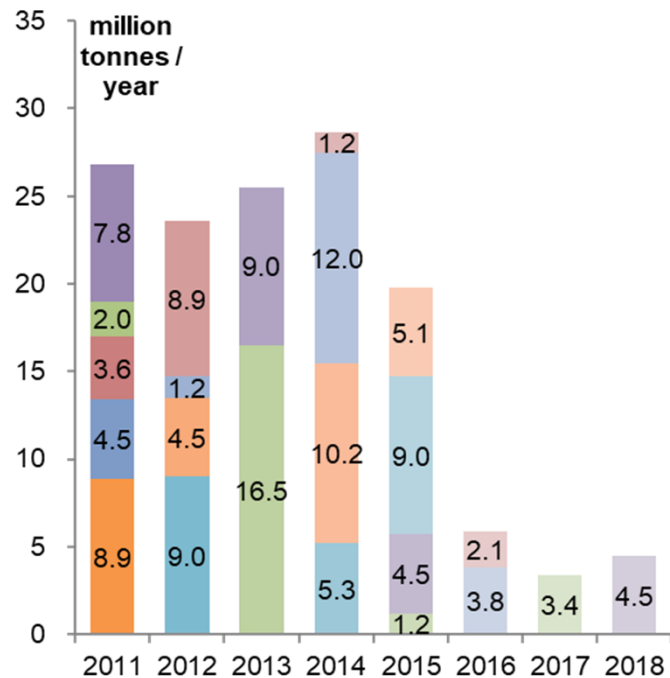
Country	Plant	Liquefaction Capacity (10,000 ton/year)	Start up (scheduled) period
Malaysia	PFLNG	120	2017
Australia	Prelude	360	2018
Cameroon	Cameroon FLNG	240	2018
Mozambique	Coral LNG	340	-
Equatorial Guinea	Fortuna LNG	220	-

Source: Kimiya Otani, *Current Situation of FLNG Terminals and Related Technologies* (IEEJ website (in Japanese))

Final Investment Decisions (FID)

- Investments in new liquefaction projects have been stagnant due to weak crude oil prices since the summer of 2014.
- There is rising momentum for FID of new projects thanks to a recovery in crude oil prices and rising demand for LNG in emerging countries.
 - In May 2018, Cheniere made the FID for Corpus Christi T-3 (4.5 million tons).
 - Reports indicate FID are close for new projects in Mozambique and Canada, etc.
- FID up to 2019 are extremely important in terms of securing a stable supply-demand balance over the medium to long term.

FID trends since 2011



Main projects with expected FID in future

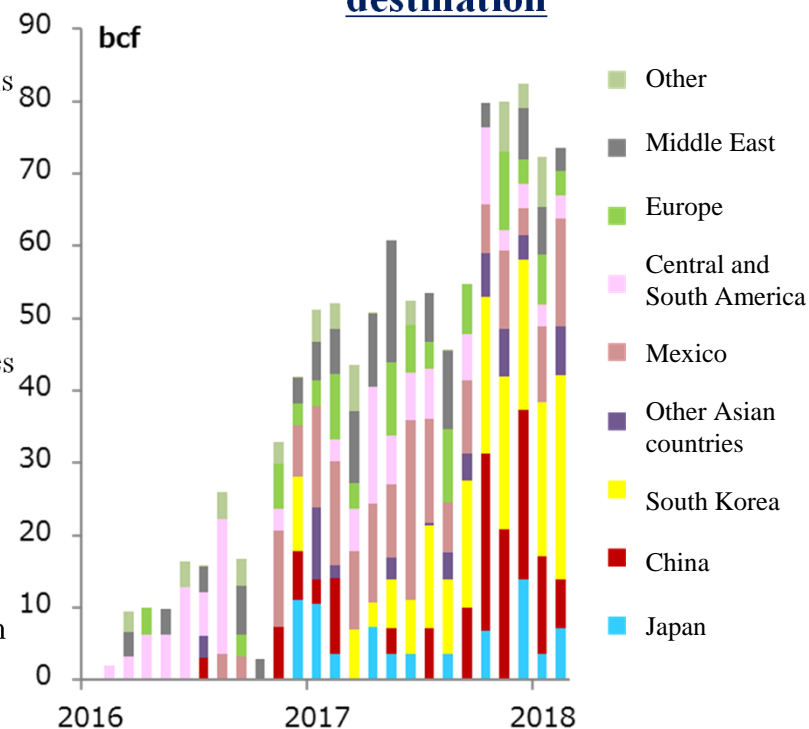
Country	Project	Capacity	Partners
Mozambique	Area-1	12.0	Anadarko, Mitsui, ONGC, etc
Mozambique	Area-4	10.0	ExxonMobil, Eni, CNPC, etc
Canada	LNG Canada	13.0	Shell, PetroChina, Mitsubishi, Petronas, etc.
Eq. Guinea	Fotuna LNG	2.2	Ophir, GE Petrol
US	Golden Pass	15.6	QP, ExxonMobil
US	Driftwood LNG	26.0	Tellurian
US	Freeport T-4	5.1	Freeport LNG
US	Sabine Pass T-6	4.5	Cheniere
US	Lake Charles	16.2	Shell, Energy Transfer
US	Jordan Cove	7.8	Veresen
Australia	Scarborough	5.0	Woodside
PNG	PNG LNG T-3	8.0	ExxonMobil, Oil Search, etc.
Russia	Arctic LNG	16.5	Novatek
Russia	Sakhalin 2 T-3	5.4	Sakhalin Energy
Russia	Vladivostok LNG	15.0	Gazprom

Source: Institute of Energy Economics, Japan

Exports of LNG Produced on the United States Mainland

- Exports have steadily increased since the start of exporting in 2016.
 - Exports in 2016 totaled 2.64 million tons, but in 2017 it increased to 12.24 million tons.
 - In terms of destination, exports bound for Asia are growing.
- Export capacity of between 60 and 70 million tons is expected to be developed by 2020.
 - In particular, a number of new projects are slated to begin operations in the second half of 2018 and beyond.
- Issues for the future expansion of exports
 - Competition in Asian markets subject to crude oil prices and spot LNG prices.
 - + US LNG competitiveness is improving thanks to rising oil prices recently.
 - Restrictions on Panama Canal passage could become a bottleneck in the future.
 - + Currently, quotas are set for one vessel per one day (equivalent to 13 million tons per year). However, it is possible to obtain additional usage based on individual negotiations, depending on traffic volume in the canal.
 - + After October 2018, restrictions on the number of voyages per day and on the time of day of voyages are planned to be relaxed.

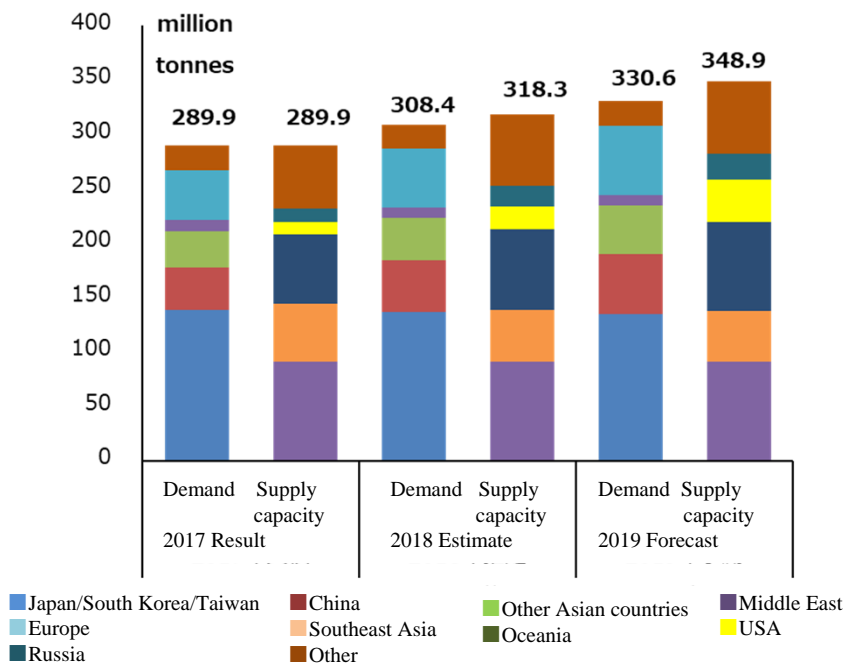
United States LNG Exports by destination



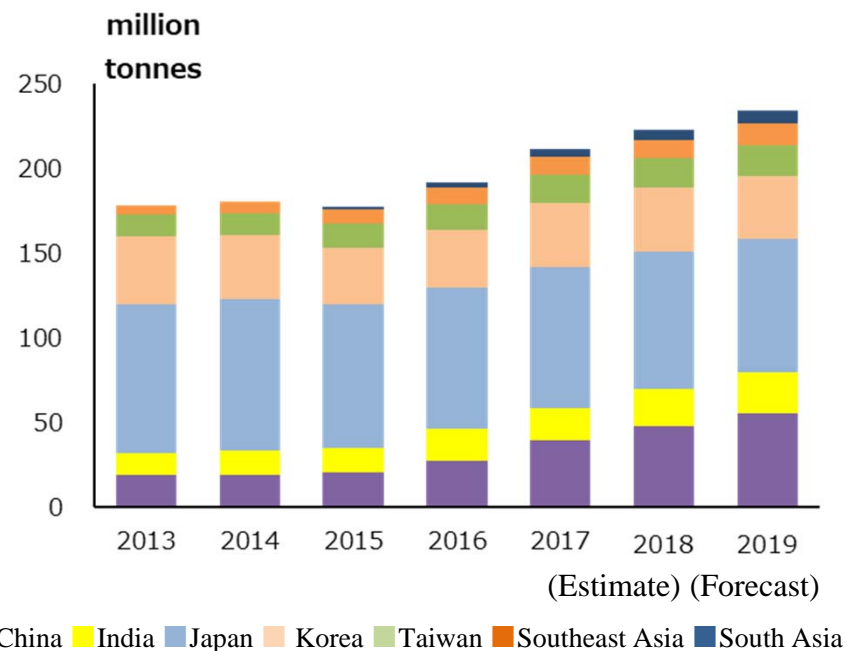
Future Supply-Demand Outlook

- Increases in supply capacity will continue to outpace demand growth up to 2019.
 - In 2018, supply capacity growth at 28.4 million tons will outpace demand growth of 18.5 million tons (full year)
 - In 2019, supply capacity growth at 30.6 million tons will outpace demand growth of 22.2 million tons (full year)
- Meanwhile, sharp increases in demand in China and other countries in 2017 have caused the current loose supply-demand condition to head toward a rebalancing, and there is rising interest in the timing of when the market will shift to tight conditions.
- LNG demand in Asia will increase from 211 million tons in 2017 to 234 million tons in 2019.

Global LNG supply-demand balance up to 2019



Asia's LNG demand*



*Figures for 2018 and onward are estimates and forecasts.

Source: Institute of Energy Economics, Japan

Outlook for Natural Gas Prices

- The price forecast of LNG arriving in Japan up to 2019 is as follows.
 - We forecast the following price levels taking into account the latest crude oil price trends, the time lag until prices are reflected in import prices, and the future level of crude oil prices and spot LNG prices.
 - The spot price of LNG could fluctuate largely based on the supply-demand conditions going forward. Taking into account the overall trend of supply-demand balance, the average spot price of LNG in the second half of 2018 and 2019 is forecast to range between around \$8 and \$9/mmbtu.

Price	January to May 2018 (Actual data)	July to December 2018 (Forecast)	2019 average (Forecast)
LNG arriving in Japan	\$9.9/mmbtu	\$11.3/mmbtu	\$10.9/mmbtu