LNG Investment Activities in 2019

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Abstract

In 2019, the aggregated capacity of large-scale LNG production projects that reached a final investment decision (FID) was the largest in the history. As a shift of fuels from coal and oil to natural gas is progressing, the importance of LNG as a means of transportation of natural gas is expected to increase further. In this paper, the author compares characteristics of locations and status of customer acquisition for eight LNG projects which reached an FID from October 2018 to December 2019 and outlines prospects for future LNG investment activities.

Key words: LNG, Investment, Natural Gas, FID, 2019

1. Introduction

In 2019, the aggregated capacity of large-scale LNG production projects that reached a final investment decision (FID) was the largest in the history as expected, over 70 million tonnes per annum (mtpa) from six projects. As a shift of fuels from coal and oil to natural gas is progressing, the importance of LNG as a means to transport natural gas is expected to grow further. In this paper, the author compares characteristics of locations and progress of marketing activities for eight LNG projects which reached an FID from October 2018 to December 2019 and outlines prospects for future LNG investment activities. An overview of those projects is presented in the **Table.1**.

2. LNG projects Overview

(1) LNG Canada (FID: October 2018)

The LNG Canada project originally emerged in 2012 and at that time had a target to reach an FID by 2016. However, the project activity was temporarily suspended in July 2016 due to unfavorable price conditions from 2015. Thereafter, with recovering LNG and oil prices, project activities resumed. Petronas, which canceled another LNG project in Western Canada in May 2018, joined the joint venture, which reorganized share distribution among parties and reached an FID in October 2018.

Produced LNG will be offtaken by the equity partners on pro rata basis. This arrangement is known as “equity lifting”. The LNG Canada joint venture does not have sales and purchase contracts with LNG consumers directly, unlike traditional LNG projects based on sales and purchase contracts. The shareholders of the LNG Canada projects are: Shell (40%); Petronas (25%); DGI (15%); PetroChina (15%); and KOGAS (5%).

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Table 1: Project FIDs (October 2018 - December 2019)

Porject	FID	Location	Operator	Capacity (mtpa)	Operation
LNG Canada	2018/10	Western Canada	LNG Canada (Shell, Petronas, DGI (Mitsubishi), PetroChina, KOGAS)	14	2025
Tortue FLNG	2018/12	West Africa	BP, Kosmos Energy	2.5	2022
Golden Pass LNG	2019/02	Gulf of Mexico, U.S.	Golden Pass LNG (Qatar Petroleum, ExxonMobil)	15.6	2024
Sabine Pass LNG Train 6	2019/06	Gulf of Mexico, U.S.	Cheniere Energy	4.5	2024
Mozambique Area 1 LNG	2019/06	East Africa	Mozambique LNG 1 (Total, etc..)	12.88	2024
Calcasieu Pass LNG	2019/08	Gulf of Mexico, U.S.	Venture Global	10	2022
Arctic LNG 2	2019/09	Arctic Russia	NOVATEK	19.8	2023
Nigeria LNG Train 7	2019/12	Western Africa	NLNG (NNPC, Total, Shell, Eni)	7.6	2024

DGI, a wholly owned subsidiary of Mitsubishi Corporation, has signed sales and purchase contracts with Tokyo Gas, Toho Gas and JERA with volumes provided from LNG Canada.

This project is located on the West Coast of North America. This yields an advantage in transportation because there is no choke point in the route and the distance is relatively short to the Asian market which is expected to have even greater demand in

the future. This project was the first greenfield large-scale project that reached an FID after the Yamal LNG project in 2013.

Table 2: Partners of LNG Canada

Investor	Offtake (mtpa)	Share
Shell	5.6	40%
Petronas	3.5	25%
DGI (Mitsubishi)	2.1	15%
PetroChina	2.1	15%
KOGAS	0.7	5%

Table 3: DGI's Sales and Purchase Contracts

Buyer	Period	Volume (mtpa)	Notes
JERA	15	1.2	2024- DES
Tokyo Gas	13	0.6	2026- DES
Toho Gas	15	0.3	2026- DES

(2) Greater Tortue Ahmeyim FLNG (FID: December 2018)

The Greater Tortue Ahmeyim project offshore West Africa selected a floating LNG (FLNG) vessel as its liquefaction facility. In some cases, FLNG could reduce initial cost compared to an onshore plant. Natural gas produced from the offshore gas field will flow into the FLNG and will be liquefied in the offshore vessel. Kosmos Energy discovered the gas field in 2015. BP joined the project in 2016 and reached an FID for an LNG export project in December 2018.

BP Gas Marketing will be the sole offtaker of the project. This is similar to LNG Canada in a sense that there is no sales and purchase contract with consumers directly. BP will sell the volumes from the project as part of its portfolio. Construction period is expected to be relatively short and the project is expected to start operation in 2022.

The project is located offshore West Africa and close to Europe where countries have been increasing import of LNG recently.

(3) Golden Pass LNG (FID: February 2019)

Golden Pass LNG plans to liquify and export natural gas from the Permian Basin, that has huge reserves of natural gas and continues producing a large volume of natural gas, including associated gas production. The Golden Pass site had been originally developed as an LNG receiving terminal. As the shale revolution has changed the gas market dramatically, significant import of LNG is no longer needed. Therefore, the owners have intended to convert their LNG import infrastructure to export infrastructure utilizing existing facilities such as LNG tanks. Some other LNG export projects in the United States also have been developed in the same manner. The Golden Pass export project was initiated in 2012 by applying an export license to Department of Energy (DOE). They have obtained all necessary regulatory permits and reached an FID in February 2019.

The project is funded by two LNG giants, Qatar Petroleum and ExxonMobil, and does not have sales and purchase contracts with consumers directly. Ocean LNG, a joint venture of Qatar Petroleum and ExxonMobil, will be the sole offtaker of the project.

The project is located on the Gulf of Mexico, Texas. There is no choke point in the ocean transportation route to the European market. Meanwhile for transportation to the Asian market, the shippers will have to pay higher transportation costs than transportation to Europe because the distance from the Gulf region to the Asian market is relatively long. In addition, the shippers will have to transit through the Panama Canal. The expansion of the canal was completed in 2015.

(4) Sabine Pass LNG Train 6 (FID: June 2019)

Sabine Pass LNG has already five liquefaction trains operating at the site. The operator Cheniere is developing a sixth train. The company had developed its earlier projects with traditional financing arrangements, creating a foundation by securing multiple long-term offtake contracts. Train 6 has already signed a deal with Petronas providing 1.1 mtpa for 20 years. Any excess capacity not sold under long-term contracts is available for Cheniere's integrated marketing function to sell into the global market.

This project is located on the Gulf of Mexico, Louisiana. The characteristic of location is the same as Golden Pass LNG.

(5) Mozambique Area 1 LNG (FID: June 2019)

Mozambique Area 1 LNG has attracted attention as a large-scale project comparable with LNG Canada. Anadarko discovered a gas field offshore of Mozambique in 2010, initiating the LNG project. The project joint venture reached an FID in June 2019 after they signed its first sales and purchase contract with Électricité de France (EDF) in February 2018, and other many customers later, for aggregated volumes equivalent to about 90% of capacity. The project created its financial foundation by making traditional offtake contracts. However, those contracts have some new features such as using European gas prices index, no destination restriction, and flexible cooperation between two companies.

The project is located on the East Coast of Africa, Mozambique.

This will be the first onshore LNG production facility in the region. As the location is close to India and other South Asian countries, the project joint venture has negotiated deals with Asian consumers. JERA, Tokyo Gas, Tohoku Electric Power of Japan, CNOOC of China, CPC of Chinese Taipei, Bharat Petroleum of India, and Pertamina of Indonesia have signed sales and purchase contracts with the Mozambique joint venture. Furthermore, the location is also suitable to transport LNG to Europe via Suez Canal or Cape of Good Hope. EDF and Centrica signed contracts, too. The good location for transportation is one of the reasons enabling many contracts.

Table 4: Long-Term Contracts by Mozambique Area 1 LNG

Buyer	Period	Volume (mtpa)	Notes
EDF	15	1.2	
Tohoku Electric Power	15	0.28	DES
CNOOC	13	1.5	
Tokyo Gas / Centrica	- early 2040s	2.6	Flexible offtake between two companies
Shell	13	2.0	
Bharat Petroleum	15	1.0	
Pertamina	20	1.0	
JERA / CPC	17	1.6	DES, No destination restriction

(6) Calcasieu Pass LNG (FID: August 2019)

Calcasieu Pass LNG is a sole greenfield project of this report in the United States, promoted by Venture Global, a new entrant to the LNG industry. This project was started in 2014 by applying to DOE. This plant will install modular liquefaction trains (constructing smaller trains on the offsite and assembling at the onsite) to reduce initial and running costs. Venture Global signed sales and purchase contracts with some European consumers to create financial foundation.

The project is located on the Gulf of Mexico, Louisiana. The characteristic of location is same to Golden Pass LNG.

Table 5: Long-Term Contracts by Calcasieu Pass LNG

Buyer	Period	Volume (mtpa)	Notes
Shell	20	1.0	HH linked pricing
Edison	20	1.0	
Galp	20	1.0	
BP	20	2.0	
Repsol	20	1.0	
PGNiG	20	1.0	FOB

(7) Arctic LNG 2 (FID: September 2019)

Arctic LNG 2 is promoted by Russian independent NOVATEK, as its second LNG project in the Arctic region.

The project is developed in an “equity lifting” format similar to LNG Canada, with volumes of LNG offtake to be distributed based on the share of investment. The shareholders are NOVATEK (60%), Total (10%), CNPC (10%), CNNOC (10%), and Japan Arctic LNG (10%). NOVATEK has signed sales and purchase contracts with Repsol and Vitol, 1 mtpa each for 15 years.

The project is located in the Russian Arctic region which is relatively close to Europe. NOVATEK's first Arctic LNG project, Yamal LNG, has been providing much LNG to Europe since it started operation at the end of 2017. Arctic LNG 2 is expected to operate in a similar manner as Yamal LNG. NOVATEK plans to develop LNG transshipment terminals to transfer cargoes from ice-class LNG carriers to conventional LNG carriers to optimize ship operation. NOVATEK also plans to increase the Arctic marine route (Northern Sea Route, or NSR). An LNG carrier, through the Bering Strait after NSR, could reach the Asian market much faster than otherwise.

Table 6: Shareholders of Arctic LNG 2

Investor	Offtake (mtpa)	Share
NOVATEK	12.0	60%
Total	2.0	10%
CNPC	2.0	10%
CNOOC	2.0	10%
Japan Arctic LNG	2.0	10%

(8) Nigeria LNG Train 7 (FID: December 2019)

Nigeria LNG has six liquefaction trains operating at the site. The expansion project will develop a seventh train. Nigeria, one

of the traditional oil and gas producers, has provided LNG to Europe, which is relatively close to Nigeria. The planned nominal capacity of Train 7 itself is 4.2 mtpa. The project also plans to improve efficiency of the existing facilities (debottlenecking), leading to the total additional capacity of 7.6 mtpa in the project.

Customers' identities of the Train7 project haven't been revealed yet.

3. Projects with Anticipated FIDs

Table 7 indicates the list of projects that are anticipated to reach FIDs after 2020. The aggregated capacity of those projects is about 270 mtpa, which represents 86% of 313 mtpa of LNG traded in the world in 2018.

Table 7: Projects with Anticipated FIDs after 2020

Project	Capacity (mtpa)
Driftwood LNG	27.6
Plaquemines LNG	20.0
Gulf LNG	10.0
Texas LNG	4.0
Lake Charles LNG	16.45
Corpus Christi LNG Stage III	9.52
Port Arthur LNG	13.5
Rio Grande LNG	27.0
Freeport LNG Train 4	5.0
Delfin FLNG	13.0
Cameron LNG Trains 4, 5	10.0
Annova LNG	6.0
Magnolia LNG	8.0
Jordan Cove LNG	7.8
Energía Costa Azul LNG	2.4
North American Pacific LNG	3.0
Woodfibre LNG	2.1
Goldboro LNG	10.0
Bear Head LNG	8.0
Qatargas LNG Expansion	49.0
Rovuma LNG (Area 4)	15.2
Djibouti FLNG	3.0
Etinde FLNG	1.3

4 Comparison with Past Projects

4.1 Liquefaction Capacity Sanctioned

In 2019, the aggregated capacity of FID LNG production projects was the largest in the history.

During 2011 to 2015, the average of the aggregated capacity of FID LNG production projects in a year was about 30 mtpa. But in 2016 and 2017, it was below 10 mtpa. At that time, plunging LNG prices along with oil prices turned producers negative toward FIDs. In fact, as mentioned above, the LNG Canada partners once postponed their schedule of FID in 2016. This may have caused tightness of LNG supply in early 2020 where production expansion couldn't catch up with expected demand growth. The anticipated potential tightness may have given producers optimistic ideas that it would be easy to attract customers to future LNG production projects.

The recovery of oil prices in 2017 and 2018 was another reason. As most of existing long-term LNG sales and purchase contracts are linked with oil prices, LNG prices are still heavily affected by oil prices. Although oil indexation tends to decrease in new LNG contracts, it is still significant. After Brent recovered from USD 30/bbl in January 2016 to USD 80/bbl in October 2018 gradually, it was stable at USD 60 USD 70/bbl during 2019.

4.2 Financing of LNG Production Projects

Project funding has been diversified from previous projects, as a result of the changing market conditions such as increasing demand and spot trading.

As a traditional way of project development, securing long-term sales and purchase contracts with end-use customers had been a significant milestone to reach an FID. However, portfolio players such as BP, Shell, Total and ExxonMobil or giant NOCs such as Qatar Petroleum, Petronas do not necessarily need LNG sales contracts to proceed their LNG production projects. Because they have numerous own LNG supply sources and different customers all over the world, they have thought that they can sell their LNG volumes through their portfolios. **Figure 1** expresses each project's status of customer acquisitions at the point of FIDs in 2019 and 2009-2010. In 2019, while share of contracts with end-use customers was relatively low, shares of contracts with portfolio players or no contract cases were remarkable.

Spot and short-term contract volumes represented 34% of the total LNG traded in the world in 2019. Increasing liquidly and flexibility of LNG transportation has made spot trading and portfolio players so active. While it is important to acquire customers for an LNG production project to proceed by following a traditional idea, the current over-supply capacity conditions

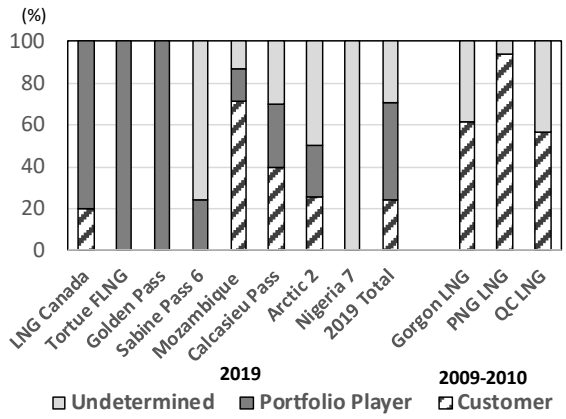

Figure 1: Status of Customer Acquisition at FID Point

make it difficult to acquire customers without flexibility, transparency, stably operation and other attractive conditions.

Figure 2 shows capacity control over liquified facilities by selected companies. Both portfolio players and NOCs have expanded their shares and is expected strengthen influences in the market further.

As a different example, Driftwood LNG promoted by Tellurian is offering customers LNG volumes packaged with Tellurian Holdings stocks. Tellurian Holdings has its own exploration and development company and pipelines, LNG facilities. Customers can use Tellurian Holdings' feedgas and infrastructure to reduce various costs.

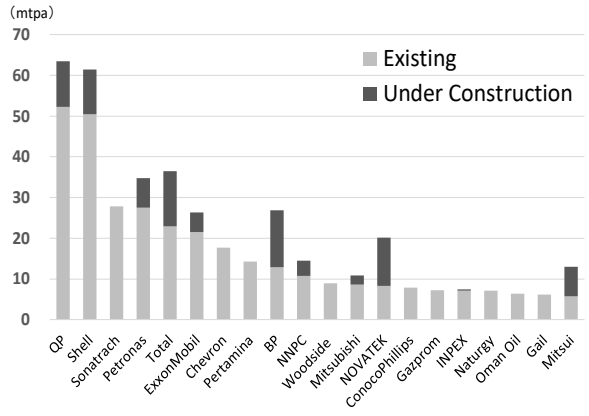

Figure 2: LNG Supply Capacity Control Held by Companies

4.3 Project Development Lead Time

Lead times of new projects from initial ideas, to FIDs and commercial operations are also different by project. A project with traditional development model like Mozambique Area 1 LNG starts from exploring and developing gas field, having a long lead time from planning to commercial operation, with higher total initial cost and requirement to secure foundation customers, as well as potential delay in development.

Those LNG production projects which utilize grid gas, including shale gas, as feedgas in the United States, do not need to explore and develop their own dedicated gas fields. Those LNG production projects that plan to convert existing LNG receiving terminals, such as Golden Pass, already have some facilities and only have to construct liquefaction facilities, berths, and additional pipelines if needed. Therefore, they need relatively shorter lead time than traditional greenfield projects and reduce construction costs. This is also the case for other brownfield projects such as Sabine Pass. And, portfolio players do not need to secure customers for individual projects before FIDs, and they can flexibly change their project schedules and promptly make investment decisions.

4.4 Reducing Construction Cost

Reducing construction cost is very important. This could have a direct influence over offering LNG prices and project funding. The emerging FLNG concept has had significant impact on upstream development. Some offshore gas fields with relatively small reserves or far from shore can be profitably developed with low initial cost through high versatility of FLNG. Shorter construction period than onshore plants is another reason to be considered as an option. Although FLNG has some demerits of adapting to onsite environment or inability to expand capacity, the number of projects to be considered for FLNG development is expected to increase in the future.

Some projects, including Driftwood LNG, Calcasieu Pass LNG, Venture Global Plaquemines LNG, and Corpus Christi LNG Stage III, are planning to install many small modular liquefaction trains that have small capacity of around 1 mtpa. Those modular trains constructed at offsite factories will be assembled at the onsite. They can reduce amount of onsite work and their initial costs by using modular trains.

5. Future Prospect

Currently, most of LNG production projects that are anticipated to reach FIDs soon are concentrated in the Gulf of Mexico region, United States. As U.S producers have sold much of LNG under Free on Board (FOB) contracts, they are expected to improve LNG market's liquidly. If those all anticipated projects proceed as scheduled, U.S LNG production capacity will skyrocket and will catch up or surpass those of Qatar and Australia. The Federal Energy Regulatory Commission (FERC) plans to install a new office specialized in LNG projects in Houston to meet many applications.

However, there are some doubts that all proposed projects will proceed as scheduled. As some projects do not have enough sales and purchase contracts to underpin their financing, they may postpone their FID schedules. Diversified LNG producers have to compete with each other, reducing initial or running cost, optimizing transportation to beat their competitors and to acquire customers. At this point, portfolio players have strong advantages as they already have various LNG facilities and many kinds of customers. New entrance companies must have different advantages which existing companies do not have, which is a key to successful development. Furthermore, the historically low spot LNG prices are another concern. Plunging LNG prices along with oil prices discouraged LNG project developers to reach FIDs in 2016 and 2017. The current low spot LNG prices are a factor that reduces the buyer's desire to conclude long-term purchase contracts, which may hinder progress of LNG production projects. In addition, it may be difficult for LNG project developers to secure EPC contractors when multiple huge projects are in progress simultaneously. There are only a few EPC contractors that can take care of large-scale LNG production projects, and there is a concern over rising construction costs, rising labor costs and delays in project implementation.

If all anticipated projects proceed as scheduled, LNG production capacity will increase rapidly in not only in the United States but also all over the world. There may be over supply situations depending on how demand develops. Effort to expand demand, such as investment on the demand side and market development, are also required to ensure customers. Notably, the United States has had the trade problem with China, where LNG demand is expected to increase significantly.

According to “The Role of Gas” published by the IEA (International Energy Agency) in July 2019, natural gas is positioned as an energy source that plays a role in various sectors, and switching from more polluting fuels to natural gas is very important. However, it states that natural gas is not a solution to long-term climate change. In addition, energy used for liquefaction of natural gas is also regarded as a problem. Some LNG producers have plans to procure all energy used in their LNG facilities from renewable energy sources. Climate change measures may limit the growth of gas demand in developed countries, especially in Europe. On the other hand, in emerging countries in Asia, whether natural gas can be introduced instead of coal is an important factor in climate change policies. It is necessary to diversify LNG supply sources, improve liquidity in transactions and enhance price competitiveness in order to have LNG play an important role. More investment will be needed to achieve those objectives.

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