Floating Storage Regasification Units (FSRUs) have become an integral part of the global LNG industry and have facilitated recent growth in demand for LNG. FSRUs are used in LNG import projects around the world and are attractive because they typically allow the project to come online faster and more economically than would be the case with a land-based terminal. FSRUs can also be attractive for other reasons, including different tax or permitting regimes and lower capital expenditures for the LNG import project developers. Additionally, an important and often less emphasized advantage of FSRUs is the flexibility they offer to be deployed on a short-term basis or, if the project does not proceed as originally planned or reaches the end of its useful life, to be redeployed to another project. It is for these reasons that numerous FSRU-based LNG import projects have been developed in recent years, and in many cases, it is arguable that the project would not have been developed without the FSRU. Thus, FSRUs have played a key role, and continue to play a key role, in growing demand for LNG. This paper is a case-study review of several FSRU-based LNG import projects, including the way that an FSRU has played a key role in each project and the way the project has served to grow LNG demand and meet local natural gas needs. This paper also offers two recommendations for project developers and FSRU owners moving forward to facilitate more FSRU-based LNG import projects and greater LNG demand at these projects.
Introduction

Floating Storage Regasification Units (FSRUs) have become an integral part of the global LNG industry and have facilitated recent growth in demand for LNG. FSRUs are used in LNG import projects around the world and are attractive for a number of reasons. First, an LNG import project can typically come online much faster if it can utilize an FSRU that is already built, as opposed to needing to construct onshore LNG storage and regasification facilities. Second, an LNG import project is typically less expensive with an FSRU, both because the overall price tag is lower, and also because the project pays a monthly hire rate to the FSRU owner instead of being required to raise the funds upfront and use the funds to build facilities. Third, in some cases, it is advantageous from a local permitting or tax perspective for the import project to be floating in the ocean and not sitting onshore in the local jurisdiction. Fourth, and of particular focus in this paper, FSRUs can be deployed on a short-term basis or, if plans changes or a project reaches the end of its useful life, redeployed to other locations.

It is for these reasons that numerous FSRU-based LNG import projects have been developed in recent years, and in many cases, it is arguable that the project would not have been developed without the FSRU. It is in this manner that FSRUs have played a key role, and continue to play a key role, in growing demand for LNG. The following is a case-study review of several FSRU-based LNG import projects, including background on the project, what drove the creation of the project, how an FSRU has played a key role in the project, and how the project has grown LNG demand and help meet local natural gas needs.

1. Argentina: Bahia Blanca (Excelerate Energy)

Historically, Argentina’s domestic natural gas production was sufficient to meet local gas demand and to sustain pipeline exports to Chile and Uruguay. Domestic gas supply eventually decreased, however, and in 2006 Argentina cut off exports of natural gas to Chile. The following year, in 2007, YPF decided to pursue an LNG import project and selected Bahia Blanca as an ideal location. Just 10 months later, in May 2008, the first cargo arrived at the new Bahia Blanca GasPort, the first LNG import facility in South America. Bahia Blanca was developed by Excelerate Energy and included an FSRU.

At Bahia Blanca, the FSRU was docked at an existing jetty connected to the onshore natural gas pipeline network. The facility allowed delivery of up to 400 million cubic feet of gas per day to the Argentine gas market. The facility was constructed using an existing jetty and required custom-tailored solutions for the LNG unloading arms to work properly. Different FSRUs have participated in the project over the years including the Excelerate Excellence and Excelerate Excelsior.

In recent years, however, the tide has turned in Argentina, and domestic gas production from the Vaca Muerta shale play is on the rise. Argentina is once again exporting gas to Chile, on a seasonal basis, and is preparing to produce LNG for sale on the worldwide market. To that end, this past year YPF entered into a 10-year agreement to utilize Exmar’s floating liquefaction vessel, the Caribbean FLNG (to be renamed Tango FLNG). To make room for the Caribbean FLNG, and in light of a decreasing need for LNG imports in Argentina, YPF allowed its contract for the FSRU to expire last year and, on October 30, 2018, the FSRU departed Bahia Blanca.¹

Bahia Blanca is a remarkable example of how quickly an FSRU-based import project can come online and meet a local gas requirement, while at the same time driving growth in demand in the LNG market. During its ten years of operations, the FSRU-based import project allowed YPF to import significant quantities of LNG into Argentina and supplement domestic gas production, and when gas production increased, the FSRU design gave YPF the flexibility to shut down the import terminal with minimal sunk costs and make room for Exmar’s Caribbean FLNG. At the same time, it gave Excelerate the ability to redeploy its FSRU at another location.
2. **Brazil: Bahia de Guanabara (Golar Winter & Excelerate Experience)**

The Bahia de Guanabara LNG import terminal in Brazil was developed as a back-up fuel supply to power plants in Brazil. Brazil is a natural gas producer, but the quantities of gas it produces are insufficient to fuel power plants in years when rainfall is low, as Brazil depends heavily on hydro power. In 2001, for example, Brazil suffered power shortages that crippled the country. Brazil’s state oil company Petrobras decided to take affirmative steps to address this issue and launched efforts to import LNG, and in 2009, the Bahia de Guanabara FSRU-based import project started operations. The project involved an investment of approximately US$410 million.ii

Early in its operations the Bahia de Guanabara project was serviced by the Golar Winter, and then starting in 2014 by Excelerate Energy’s Experience. The primary purpose of the project has been to supply gas to thermal power plants in the region. This proved particularly important from 2011 to 2015 when rainfall dropped and the Brazilian economy (and with it, power demand) grew. During that period, LNG imports in Brazil increased dramatically.

The flexibility of FSRUs has proved particularly beneficial in Brazil. After the growth period of 2011 to 2015, power demand began to decrease, and the rains returned to the region of Bahia de Guanabara, so much so that in June 2016, the Experience FSRU was moved to another location in Brazil. Since then, Brazil’s FSRU strategy has been to move FSRUs between locations as needed.

Bahia de Guanabara is a good example of an FSRU providing an opportunity for LNG imports during a required season and thereby driving growth in LNG demand. Although the introduction of an FSRU-based import project in Bahia de Guanabara has not resulted in a steady, growing stream of LNG imports into Brazil since its inception in 2009, it has, on the whole, created greater demand for LNG, and without the FSRU technology, and its flexibility to be deployed to different locations, the Bahia de Guanabara import project and projects like it would be riskier to develop. The project is also a good example of an FSRU-based terminal costing much less than a land-based terminal would cost.

3. **Colombia: Cartagena (Höegh Grace)**

The story of LNG in Colombia is much like the story of LNG in Brazil. Traditionally, Colombia was a net gas producer, but eventually, by 2016, gas consumption caught up with decreasing gas production and Colombia became a net importer of gas. That same year, the FSRU-based SPEC LNG import terminal commenced operations in Cartagena, Colombia. The terminal is owned by Sociedad Portuaria El Cayao and employs the Höegh Grace FSRU. Imports were initially relatively low, but increased towards the end of 2017.

Like Brazil, Colombia depends heavily on hydro power. Currently 75% of power generation in Colombia is from hydro power. LNG now serves as a back-up fuel to hydro power in Colombia, and LNG supplied into the FSRU-based SPEC LNG terminal provides important assurance of power during low rainfall periods.

The FSRU solution has proven successful in opening Colombia to the worldwide LNG market and helping drive growth for LNG demand. The SPEC LNG terminal required an upfront capital investment of only US$150 million.iii Without the FSRU option, the SPEC LNG terminal would have required a greater up-front investment.
4. Pakistan: Port Qasim (Excelerate Exquisite)

The need for LNG in Pakistan centers on its power sector. In recent years Pakistan faced frequent power cuts and serious energy shortages. It had insufficient domestic gas production to produce the amount of power required by the country, and was expected to run out of gas within 20 years. In response to these challenging circumstances, Pakistan turned to LNG.

On April 30, 2014, Engro Elengy Terminal Private Ltd. and Pakistan’s national gas distribution company Sui Southern Gas Company signed an LNG service agreement, for Engro to provide LNG tolling services to Sui Southern Gas. The project was designed to handle 3 mtpa of LNG for 15 years. As a fast-track solution to Pakistan’s energy crisis, the terms specified that the infrastructure of the terminal, which would be located in Port Qasim, had to be constructed in 335 days. Construction of the terminal would require a 24 km high pressure piping network and a new jetty. The terminal was built in the required 335 days, with only 179 days of actual construction.

On March 27, 2015, the Exquisite, one of Excelerate Energy’s FSRUs, arrived in Port Qasim. In less than three days, it completed commissioning activities and regasification acceptance test and entered commercial service on March 31, 2015. Utilizing the Exquisite, the LNG import terminal can deliver up to 690 million cubic feet per day of natural gas directly to Sui Southern Gas Company’s natural gas pipeline system. When implemented, the Port Qasim LNG import project was projected to reduce the costs of power generation in the country by 40%.

In the Port Qasim LNG project, the FSRU was instrumental in helping the project enter commercial service in a remarkably short period time, of less than one year. This drove increase in LNG demand and continues to do so.

5. Egypt: Ain Sokhna (Höegh Gallant)

Egypt is a gas producing country but by 2014, domestic gas production could not keep up with demand, and the country faced power shortages. During this time, Egypt turned to LNG imports to supplement domestic gas production.

On May 12, 2014, the Egyptian Natural Gas Holding Company (EGAS) entered into a letter of intent with Höegh LNG to supply an FSRU for a five-year term. Several months later, on November 3, 2014, they signed an agreement under which Höegh would provide and operate an FSRU in the Ain Sokhna port for five years. Thereafter, the Höegh Gallant FSRU arrived and commenced operations on April 29, 2015.

Ain Sokna LNG import terminal was in operations for several years. However, during this time, new gas fields were discovered including at Zohr, Egypt, and domestic gas production increased. By mid-2018, Egypt ended LNG imports, and in October 2018, EGAS renegotiated its contract with Höegh to allow the FSRU to be used by a third party as an LNG carrier, with EGAS paying the difference in rates.

Two characteristics of FSRUs in particular made the Ain Sokhna LNG import terminal successful: speed of deployment and flexibility for short-term deployment and them redeployment. From signing the agreement in November 2014 until startup in late April 2015 was only six months, allowing the FSRU to step in quickly and help solve the decreasing domestic gas production. Similarly important was the ability for Egypt to contract to use the FSRU for only a five-year period and, once it became evident that the Egypt no longer needed the FSRU during that five-year period, to be able to redeploy the FSRU for other use. A land-based terminal could not have been built so quickly and, once built, would not have been a good investment given the short duration of the operations of the LNG terminal, nor would it have been able to be redeployed. The FSRU design with its flexibility allowed Egypt to meet its short-term energy goals and drive LNG demand during that period of time, while it developed new gas fields.
6. Jordan: Aqaba Port (Golar Eskimo)

Jordan relies on gas imports more than most of the countries in its region. In 2009, gas accounted for 40% of Jordan’s primary energy consumption. Much of this included gas pipeline imports from Egypt. In 2011, terrorists attacked the Arab Gas Pipeline (AGP) linking Jordan with Egypt, Syria and Lebanon. This caused a sharp decrease in gas supply, dropping gas to 12% of energy consumption, and Jordan was forced to switch to burning diesel in many of its gas-fired power plants.iii In the midst of this energy crisis, the government of Jordan turned to LNG, with the goal of displacing diesel and fuel oil imports and consumption.iv

On July 31, 2013, Jordan entered into a ten-year time charter party with Golar for the charter and use of the Golar Eskimo FSRU. The FSRU is capable of storing 160,000 m³ of LNG and has a send-out capability of 750 million cubic feet per day. Under the charter party, Jordan has the right to terminate early, after year five, subject to paying an early termination fee.v

The FSRU arrived at Aqaba Port in the Gulf of Aqaba region of the Red Sea on May 25, 2015 and commenced commercial operations. Less than a year into operations, strong winds along the Red Sea shore required the FSRU to depart berth. Subsequently the FSRU returned to berth and within approximately two weeks of the original incident, the FSRU had resumed normal operations.vi

LNG imports at the LNG import terminal have increased steadily over time. Soon, Jordan was exporting pipeline gas back to Egypt. In 2017, Jordan imported 3.3 mtpa of LNG, an 8.2% increase over 2016. LNG imports have allowed Jordan to meet 90% of its power-production requirements with natural gas, reducing fuel oil and diesel imports.vii

The introduction of an FSRU-based LNG terminal in Jordan has made a significant impact on the country and driven demand for LNG. Projects like this one illustrate the key role the FSRUs play in import projects to open up countries to the worldwide LNG market.

Next Steps in FSRUs Driving More Demand

In light of the lessons learned from these FSRU project, and considering the future of FSRUs and the LNG industry generally, two practical steps can be taken by developers and FSRU owners going forward to facilitate more FSRU projects in the years ahead and, with them, greater demand for LNG.

First, parties need to seek flexibility to be ready for unexpected changes. Parties should, as in the Jordan FSRU project, consider including a charterer’s right to terminate the FSRU charter party early upon payment of a termination fee. They should also implement terms in the FSRU charter party that allow them to redeploy the FSRU to a different purpose or location, if and when needed. The practical reality is that gas demand can change, and the parties should be ready for those changes by agreeing to flexibility terms upfront, in a manner that is mutually beneficial to the charterer and the FSRU owner.

Second, as FSRUs continue to facilitate the development of new LNG import terminals and thereby drive demand for LNG, parties should look for ways to structure their project agreements to allow use of the FSRU terminal by multiple users. FSRUs will generate the most demand for LNG if they are operated as close to capacity as possible. In some projects, a sole user of the FSRU terminal may be able to maximize FSRU usage by growing downstream demand for gas. In other projects, however, a sole user of an FSRU terminal may not be able, on its own, to use the remaining capacity in the FSRU terminal, and in those cases the sole user will benefit from other users participating in the FSRU terminal. This requires carefully-structured agreements including a coordination agreement between the multiple users in order to coordinate LNG unloadings, regasified LNG send-out and pooling of LNG. From time to time, each user will likely need to borrow LNG from another user that is unloading a cargo, in order that all users will have LNG inventory that they can use to send out regasified LNG. Thereafter, as each of those borrowing users unloads a cargo, they will then be able to repay their loans to the first user. Alternately, this could be structured so that LNG is not borrowed but instead the borrowing and lending occurs at the point at which regasified LNG is sent out from the terminal. Regardless of the method used, the parties will need to coordinate
their efforts and will need to decide in advance the liability of a user that fails to unload LNG or take regasified LNG as scheduled, and thereby causes other users to be unable to perform at the terminal. Credit support requirements of the users will also need to be agreed. Once agreements are in place that facilitate multiple users, an FSRU-based import project will be better positioned to maximize its usage and, accordingly, LNG demand.

Conclusion

FSRUs have played a key role in opening up new markets to LNG imports and thereby driving demand for LNG worldwide, and the same trend should continue in the future. As illustrated by the projects summarized in the paper, FSRUs have often allowed new projects to come online relatively quickly, thereby addressing problems facing those regions in terms of gas supply and power production. In many cases, the FSRUs have also proved to be more cost-effective. And importantly, the FSRUs have provided great flexibility to allow projects to develop short-term gas solutions or, when gas demands and other factors changed, to redeploy the FSRU elsewhere or to have an FSRU ready to move between ports depending on which port has the greatest need.

References