
The background is a solid blue color with a white grid pattern. Overlaid on the grid are various white technical drawing elements, including concentric circles, straight lines, and complex geometric shapes like polygons and a large, detailed structure resembling a ship's hull or a large container in the bottom right corner.

An LNG bunkering blueprint

Aditya Aggarwal, ABS, USA, outlines how North America has provided a template for the development of a sustainable LNG bunkering value chain.



It has been almost six decades since the gas carrier sector started developing technologies, technical requirements and operational practices for the safe handling and burning of LNG. The technologies utilised for consuming the boil-off gas (BOG) produced onboard gas carriers have provided the foundation for adopting LNG as a marine fuel on ships other than gas carriers, and form a critical part of the LNG temperature and pressure management systems for these LNG-fuelled ships.

Recent orders and market activity point towards ferries and cruise ships as one of the most common types of LNG-fuelled ships, in addition to pure car truck carriers (PCTCs), containerships and product tankers. As shipowners perform the techno-economic analyses necessary to determine if LNG as fuel is the best option for their next vessel, the availability of LNG bunkering services continues to be the driving factor in the final decision. The availability of LNG as fuel at ports has long been considered by some as one of the limiting factors in the widespread adoption of LNG as marine fuel.

The primary bunkering options to supply LNG to LNG-fuelled ships are truck-to-ship, ship-to-ship and tank-to-ship, and they all present challenges. Due to the ease of deployment, truck-to-ship is usually considered as the first

bunkering method, but it is only suitable for delivering small quantities.

Land-based tank infrastructure typically requires significant investment, and the regulatory approvals and development may take many years. The use of dedicated bunker vessels is considered to be the preferred option for many operators. As a result, it is expected that there will be an increasing number of LNG bunker vessels entering into service to provide the last mile delivery solution to the industry.

Considering that LNG-fuelled ships still account for only a fraction of the global maritime fleet, it may take several years for the significant benefits of LNG-powered vessels to be fully realised. However, with ongoing efforts to eliminate the commercial and infrastructure impediments, LNG bunkering for the deep-sea segment continues to develop globally, with LNG bunkering services now available in most of the key marine bunkering hubs around the world.

Shale gas game changer

The abundance of natural gas production in the US has created a tectonic shift in the world natural gas supply chain for primary energy purposes. This growth in LNG availability has in turn also motivated a number of operators in North America

to develop their own LNG supply chains. Additionally, the oil majors and independent operators are also investing in new dedicated LNG bunker vessels to support the anticipated growth in demand for LNG as a marine fuel in the region.

With a number of new orders in the pipeline, the global LNG bunkering market is starting to gain momentum and the US Jones Act players are not far behind with support from ABS, which is readily playing its role as a key partner in supporting the development of new LNG bunkering projects in the US.

The 'Bunkering of Liquefied Natural Gas-Fuelled Marine Vessels in North America' study was published in 2015 to assist stakeholders in implementing the regulatory framework for LNG bunkering, and has been considered invaluable by the project developers. This study provides a 'road map' guide of the regulatory, stakeholder and technical issues associated with developing an LNG bunkering project in the region.

This study has proven to be a critical toolkit for owners and operators of gas-fuelled vessels, LNG bunkering vessels and waterfront bunkering facilities, by providing information and recommendations to address North American (US and Canadian) federal regulations, state, provincial and port requirements, international codes and standards. Insights gained from the first adopters of LNG-fuelled vessels and bunkering projects have helped guide future projects through the challenges and showcased solutions favoured by existing stakeholders in the sector.

In August 2019, the announcement of the formation of Polaris New Energy was accompanied with the news of the

latest order of the Jones Act LNG barge that was signed with Fincantieri Bay Shipbuilding yard in Sturgeon Bay, Wisconsin. This announcement brought the total count of Jones Act LNG bunker barges to three, and ABS has the distinction of classing all of these LNG bunkering barges.

The Polaris New Energy barge – the largest Jones Act vessel of its type ordered to date – is designed to have nominal capacity of 5400 m³ of LNG stored in four independent cylindrical IMO Type-C cargo tanks, each with a capacity of 1350 m³. The barge is expected to be delivered by the end of 2021.

During transit, the barge is expected to operate as an unmanned unit, and the essential systems and equipment will be controlled and monitored from the remote control and monitoring station (RCMS) onboard a tug by both hardwired and wireless connections, in compliance with classification requirements.

Polaris New Energy is expected to use the barge to fuel ships in Port Canaveral and the Miami/Port Everglades area. The contract with the shipyard includes the option to potentially construct two additional sister barges to allow Polaris New Energy to supply LNG bunkering services to additional LNG-fuelled vessels.

Cruise sector interest grows

Almost two years earlier, in November 2017, Shell Trading (US) Co. announced that it had executed a long-term charter agreement with Q-LNG Transport, LLC for a 4000 m³ capacity LNG bunker barge. This was considered an important step for Q-LNG towards developing the desired Jones Act LNG value chain to support greener maritime shipping in the region, in addition to committing to being a leader in the development of LNG infrastructure in the US.

The project is also considered by many as a critical first-mover in providing LNG infrastructure to the cruise shipping industry, with the design flexibility of vessel-to-vessel compatibility and equipment selection to maximise operational efficiency for bunkering LNG to fuel cruise ships.

Under the charter agreement, the Q-LNG barge will be used to bunker Carnival Cruise Line's two new dual-fuel ships and the two dual-fuel SIEM PCTCs that will be chartered by the Volkswagen Group for transporting cars from Europe to North America. Q-LNG Transport also holds an option to order a second LNG bunkering vessel that has been designed to carry 8000 m³ of LNG.

This larger design will utilise a significant amount of the detail design and engineering from the original 4000 m³ capacity design. This will allow the second LNG barge to be delivered in a much shorter period of time and further assist in cementing Q-LNG's position in the LNG bunkering industry.

Clean Jacksonville will always have the distinction of North America's first LNG bunker barge that paved the way for other projects to follow and for the regulators to develop some of the very early rule requirements. With ABS as the classification society of choice, the bunker barge, featuring GTT's membrane containment system, was ordered in the US in 2015 and has been stationed in Jacksonville, Florida, since the delivery in August 2018.

Clean Jacksonville, owned by TOTE Maritime, has been used for bunkering TOTE's two 3100 TEU, Marlin-class containerships that are currently in operation between the US



Figure 1. Polaris New Energy is expected to use its barge to fuel ships in Port Canaveral and the Miami/Port Everglades area (credit: Polaris New Energy).



Figure 2. Q-LNG Transport has executed a long-term charter agreement with Shell Trading for its 4000 m³ capacity LNG bunker barge (credit: Q-LNG).

and Puerto Rico. The barge includes a 2200 m³ capacity GTT Mark III Flex cargo containment system (CCS) and a specially designed bunkering arm to refuel the ship's bunker tanks at a transfer rate of 500 m³/hr. For commissioning of the barge, cold tests using nitrogen were performed at Conrad Orange shipyard in Texas. The barge was then mobilised to Harvey Gulf International's bunkering facility in Port Fourchon, Louisiana, for its gas trials.

Valuable lessons learned

These projects continue to provide valuable lessons learned for the US Jones Act market and are expected to lay the foundation of LNG bunkering sector in North America for years to come. The importance of collaboration among the stakeholders remains at the heart of successfully delivering a project on time and within budget.

Depending on the bunkering operation, the layout of the unit or the design of certain systems may need to be customised in order to minimise risks. Any deviation from the regulations should be highlighted early in the project development phase, in order to ensure smooth approval from both the relevant flag administration and classification society.

The CAPEX required to build new bunkering infrastructure remains high, but, as new ports begin to offer LNG bunkering services and the LNG supply chain continues to develop over the next several years, it is surely expected to benefit from the comparatively low commodity prices of natural gas in the US. As the price of US natural gas continues to fall, it presents an opportunity for the LNG bunker providers to offer competitive



Figure 3. *Clean Jacksonville*, owned by TOTE Maritime, has been used for bunkering TOTE's two 3100 TEU, Marlin-class containerships (credit: GTT).

rates and position the region as a commercially viable location for shipowners to bunker their LNG-fuelled ships in.

The future of new bunkering projects will become clearer in due course, but as environmental protection takes centre stage and cargo owners evaluate environmentally friendly international logistics to transport their cargo, it is obvious that the demand for cleaner marine fuels – LNG included – will continue to rise for the foreseeable future. **LNG**