

Offshore LNG Solutions

Technology
Creating
Value



Introduction

The SBM Gas & Power Business Unit has been created within the SBM Offshore Group to bring offshore solutions to the growing LNG market. As the pioneer in offshore loading/offloading terminals and owner/operator of the world's largest fleet of FPSOs, SBM Offshore intends to be a strong and reliable partner in the development of LNG projects worldwide. Three main families of products have been developed to cover a wide range of LNG import and export projects:

- Floating LNG Production
- Floating LNG Regasification
- Cryogenic Offshore Offloading & Loading (COOL™) Systems

Floating LNG Production

SBM Offshore and Linde have jointly developed a generic LNG Floating Production Storage and Offloading unit (LNG FPSO) that assists in unlocking gas fields that are currently considered unviable for development.

In particular, the LNG FPSO can provide a solution:

- to monetize offshore stranded gas fields currently uneconomical due to size and remoteness from markets and pipeline infrastructure;
- to monetize associated gas from oil fields currently being flared or re-injected;
- as an Early Production System (EPS), while the onshore LNG facility is under evaluation/development.

Key Features:

- Can deliver up to 2.5 mtpa of LNG, plus any associated LPG and Condensate
- Targets gas reserves of 1 - 4 tcf
- Generic design to cater for a wide range of field applications, easy to be optimised for a specific field
- Relatively simple liquefaction technology with only one mixed refrigerant
- Higher liquefaction efficiency than any competing process technology (approx. 10 - 25 % lower kWh/ton)
- Safe topsides layout confirmed by independent reputable safety consultant
- Specially designed for motion insensitivity, simplicity and robustness
- Slashing-proof and inspection/maintenance friendly SPB containment system from IHI
- Side-to-side offloading with additional provisions for tandem offloading using a floating hose
- Can be applied in any water depths beyond 25m
- Disconnectable mooring system if required

By working with SBM Offshore/Linde you will benefit from:

- reputable partners with extensive design, construction and operating experience, as well as excellent safety and operational uptime records;
- hands-on experience on projects that come closest to an LNG FPSO (Sanha LPG FPSO, Snøhvit LNG barge);
- committed to deliver the 1st LNG FPSO by 2012;
- receiving a "floating liquefaction service" on a tolling-type basis, with SBM Offshore/Linde taking responsibility for the completion and performance risk;
- possibility of flexible contract schemes to create a viable LNG supply chain.



Floating LNG Regasification



New-Build FSRU

SBM Offshore's generic new-build FSRU concept can be designed for a wide range of LNG storage requirements in SPB (for exposed locations) or membrane type (for benign environments) tanks and has an average gas send-out capacity of 1 bscf/d that can easily be increased to 2 bscf/d.

This design allows for either side-by-side or tandem offloading of the LNG Carrier (LNGC). The FSRU is moored to the seabed via a turret mooring system, which, if necessary, could be of the disconnectable type avoiding exposure to severe weather conditions on site, such as a hurricane in the Gulf of Mexico.

Key Features:

- Cost savings for marine facilities and dredging
- Easier permitting and no land acquisition
- Improve navigational safety
- Possibility of a lease and operate contract
- Flexible location selection and redeployment
- Minimize construction and delivery risk
- Generic design up through FEED detail in place
- Approval in principle from ABS



Converted FSRU

For smaller gas send-out requirements (typically ≤ 600 MMscf/d), SBM Offshore can offer an FSRU based on the conversion of an existing LNGC for storage capacity of approximately 130,000 cubic meters. Either membrane type or MOSS type (for a more exposed location) LNGCs can be employed.

LNGC offloading is primarily performed in a side-by-side configuration. SBM Offshore's generic design is equipped with an external turret mooring system, but could also be moored directly alongside a jetty or quayside, or could be of a disconnectable type, if desired.

Key Features:

- Significant cost savings compared to existing onshore LNG import terminals
- Delivery schedule of less than 2 years
- Cost savings for marine facilities and dredging
- Easier permitting and no land acquisition
- Improve navigational safety
- Possibility of a lease and operate contract
- Flexible location selection and redeployment
- Minimize delivery risk
- Approval in principle from ABS



LNG Regasification



Gas Link™

The Gas Link™ is specifically designed to supply LNG to small and isolated markets. It allows energy users currently running on diesel or fuel oil to use cheaper and cleaner LNG without the need of large upfront investments. The system consists of a conventional steel barge equipped with ambient air vaporizers and essential utilities. The LNG is stored separately onboard a chartered and permanently moored LNGC.

Key Features:

- Separation of regas and storage functions simplifies design and integration, hence relatively low capex
- Attractive lease and operate scheme avoids upfront consumer investments and eliminates consumer operations concerns
- Environmentally friendly and low opex due to use of ambient air vaporizers
- More space available on the barge than on deck of a converted FSRU
- Benign environmental conditions
- Minimal modifications to LNGC, allowing for quick exit from and re-entry into the market as a trading vessel
- Fast delivery schedule and easy redeployment



Soft Quay Mooring (SQM)

The SQM has been designed to perform safe LNGC berthing, mooring and offloading in open sea environments for fully standard LNGC's. The SQM "imitates" a conventional jetty terminal to achieve standard approach and berthing practices but increases the distance (gap) between the LNGC and the mooring berth. It provides substantial energy absorption in the berth to improve safety in a more dynamic offshore environment.

Key Features:

- Mooring configuration of LNGC similar to that of a conventional jetty terminal
- LNG and vapour transfer by conventional hard loading arms
- Use of LNGCs with standard mid-ship manifolds
- Mooring by a combination of mooring hawsers, spring lines and the soft quay
- Operations in benign to average weather conditions
- A Twin SQM (TSQM) allows for a double loading berth as shown below
- Regasification facilities on the central fixed SQM platform
- Extensive testing has been performed in model basin





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