Development of LNG-FPSO pre-FEED with KSMR Process

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ABSTRACT

Korea Gas Corporation (KOGAS) has developed LNG-FPSO pre-FEED based on KSMR process that is a new natural gas liquefaction process. The KSMR process features an SMR-based simple structure and a relatively high-efficiency. The production capacity is 2.5 mtpa. The topside process utilizes aMDEA process for AGRU, turbo expander type for NGL extraction, and N₂ flash drum type for the end flash process. The liquefaction process utilizes SWHEs for main heat exchangers, and LM6000 model for gas turbine. There are two gas turbines for refrigerant of light component (LK) and mixed refrigerant compressors and two electric motors for refrigerant of heavy component (HK) compressors, and the other electric motor for NG boosting compressor. This LNG-FPSO utilizes internal turret mooring system, KC-1 LNG Cargo containment system, side-by-side loading system.

KEY WORDS: KSMR process; LNG liquefaction process; FLNG; LNG-FPSO; pre-FEED; KC-1 Cargo containment system.

INTRODUCTION

The primary use of natural gas (NG) is as a fuel; it can also be a source of hydrocarbons for petrochemical feed stocks and a major source of industrially important elemental sulfur (Kidnay, A. J., 2006). With worldwide LNG demand increasing rapidly, LNG liquefaction plants and liquefaction processes become higher value-added industries. Its clean burning and ability to meet stringent environmental requirements have raised the demand for natural gas (Elliot, D., 2005). With an expected demand for LNG increasing, LNG liquefaction plants and liquefaction processes become higher value-added industries.

The gas & condensate resources is an offshore gas-condensate field in east Africa located 60 km from the coastline at a water depth of approximately 2,000 m. Due to the remote location of the field it will be developed as an LNG-FPSO.

The expected feed gas composition for this field is assumed clean and lean (rich concentration of methane, low concentration of CO₂, ethane, propane and heavier gases), thus speculative rich compositions of the gas will be considered to design the LNG train to handle the wide composition range of the feed. The Lean Gas composition is base gas composition of the field and the Rich Gas composition is speculative gas composition and richer than lean gas composition based on robust assumption for flexible and cost-effective design to achieve generic design concept. The proposed generic approach in principle enables a repeatable design, offering benefits in applying one initial design for different locations, thus reducing design development cost and schedule.

The several conditions from subsea system are assumed for the basis of design. The feed gas pressure shall be controlled and delivered with sufficient pressure (75 bar) from the gas well. The design feed gas supply temperature will be from 5 °C to 12 °C. Hydrate formation could occur considering operating and preservation subsea conditions. Since insulation and electric heating for the hydrate prevention is not considered, the feed gas can be considered as a cold case. Feed gas will be sent to the LNG-FPSO as the multiphase (gas + MEG + water) fluid. Water has been added to the dry feed gas to have 30 m³/hr of free water to the feed gas. In addition, the inlet facility shall be designed for a maximum liquid slug volume of up to 50 m³ from general characteristic of gas field. The hydrate prevention of the subsea flow line will be accomplished by the proper method from gas field. MEG injection is considered.

The following cases shall be considered for topside process design, equipment sizing, and mechanical equipment design for Pre-FEED and the following cases.

- Average Temperature, Rich Gas Composition (design case ATRG): This design case is based on the average annual temperature of the air and sea water intakes and shall be used to develop the Heat & Material Balance for the liquefaction unit.