INTRODUCTION

JGC considers effective use of Boil-Off Gas (BOG) which is constantly generated from LNG storage tanks is one of its new strategies for the LNG business, and has established its own “Gas Engine Power Generation System (MixGen™)” which is a rational BOG utilization system for LNG receiving terminals.

In the conventional system, BOG is boosted using a compressor for use as city gas production fuel gas and thermal power plant fuel gas or returned to the LNG tank after re-liquefaction. However, the conventional system has involved some issues to be solved, such as the high electric power consumption required for BOG boosting and the large initial investment required for BOG re-liquefaction.

Common BOG flow scheme in LNG terminal

BOG is pressurized by BOG compressor to be sent as city gas or to be fed to power generation plant.

Higher power consumption  Other method to utilize BOG?

OBJECTIVES

MixGen™ uses medium-pressure BOG directly as fuel for its gas engine generator and realizes the creation of a new electric power source and the recovery of obtained thermal energy. In MixGen™, BOG having different gas compositions and various other kinds of gases are used as fuel for the gas engine. Abrupt fluctuations in the gas composition of the fuel gas would adversely affect the operation of the gas engine. To lessen such fluctuations and ensure stable power generation, JGC innovatively developed “BOG Mixing Drum (MILDrum™)” installed upstream of the gas engine generator with a new internal device for gas caloric value adjustment. It is a key solution essential to the continued safe operation of this system.

New BOG flow scheme (proposal)

A typical Gas Engine

Features of typical Gas Engine

- Lower pressure gas can be used compared with gas turbine generator
- Higher power generation efficiency
- Enable low loading operation (10~100% load)
- Maintain higher efficiency at low load operation
- Quick start-up and stoppage operation (0% to 100% load in approx. 2min)

Criteria for power generation from BOG

Calorific value variation of BOG

Response to calorific value variation is critical

CONCLUSIONS

MixGen™ provides a stable electric power and heat supply system using BOG as gas engine generator fuel and low CO₂ emission will lead to SDGs. By using BOG mixed with gas from the LNG vaporizer, the fuel gas supply to the generator can be adjusted flexibly according to the amount of generated BOG and the need for electricity.

The gas engine is a highly value-added BOG user because it can generate electricity with high efficiency using low pressure fuel gas. As BOG fuel gas is not constant in its gas composition and generation volume, its calorific value is apt to fluctuate abruptly. To mitigate those fluctuations, the BOG Mixing Drum “MILDrum™” has been newly developed using the CFD (Computational Fluid Dynamics) analysis technique.

Introducing MixGen™ makes it possible to use the generated electric power for purposes within the LNG receiving terminal. At the same time, the generated electric power can be supplied to the market as a stable source of electric power. Additionally, highly efficient energy recovery can be realized; for instance, the thermal energy obtained (steam and hot water) can be effectively used as a heat source for LNG and LPG vaporization within the receiving terminal.

SUMMARY

- BOG (Boil Off Gas), which has high methane number, can be used as fuel gas to Gas Engines.
- Operation cost of the LNG receiving terminal can be reduced by power and heat (steam and/or hot water) generated by a Gas Engine, and low CO₂ emission will lead to SDGs.
- New Income of Electricity Selling through Gas Engine would be available.
- Calorific value variation, which will affect the performance of Gas Engine, can be minimized by MILDrum™.
- MixGen™ can also be applied to LNG receiving hub terminal.

Example of Gas Power Plant and LNG terminal

If you may have any question on MixGen™, please contact:
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