Boil-Off Gas Design for Mid-Scale LNG: How to Minimize Flaring and Ramp Up Production Safely

Presenters

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Abstract

In the pursuit of low-cost greenfield LNG facilities, many projects have considered large facilities composed of many small or mid-scale sized trains. This paper discusses how the design and controls of the boil-off gas (BOG) system for mid-scale LNG units is fundamentally different than for traditional large scale facilities. The difference arises largely due to the sequential way midscale units are constructed and commissioned over time to build the total facility capacity. The paper will address the way the boil-off gas compression system should be designed with the intent to minimize flaring and to simplify start-up with long-term stable operations in mind. The case study is an LNG facility with multiple midscale units of 0.5-1.5 MTPA each.

In a traditional LNG plant with large scale trains, the production profile typically rises quickly. Based on this production profile, during initial start-up and after a trip or shutdown, the operating personnel can also increase the feed flow to full capacity quickly. The resulting BOG generation is a function of the LNG flash in the tank; therefore, the BOG generation reaches normal design capacity rapidly in a large scale plant.

This BOG generation profile is different for multiple small or mid-scale plants where the units are started up in a staged manner over a long period of time. When the first trains are started up, the BOG generation is a very small percentage of the normal facility design generation rate. This scenario results in the centrifugal BOG compressor handling very low flow rates which are generally below the compressor minimum turndown capability. These flow rates lead to compressor operating in recycle and subsequent quenching operation. It is common knowledge from operating plants that a continuous high quench at the BOG compressor suction drum for an extended period is a difficult operation to manage with high risk of tripping, potential for liquid carryover, and challenging overall liquid management. There will also be problems associated with management of fuel gas as the excess quench has to be consumed when BOG is utilized as fuel gas.

This paper proposes an approach to design the BOG compression system with a combination of compressors so as to effectively manage the BOG generation in the early commissioning and start-up of the facility as well as after shutdown or a trip. It also minimizes the operational complexity during initial and subsequent start-ups.

In essence, this paper delineates the design which reduces significant flaring during prolonged commissioning and subsequent future re-starts throughout the life cycle of the facility. This is definitely a step towards conscious carbon reduction as part of the LNG value chain.