Influence of Degradation on Gas Turbine Usage for Natural Gas Transportation

Duabari Aziaka
HE Engineering Centre, Loughborough College, United Kingdom

Obhuo Mafel
Center of Power & Propulsion, Cranfield University, Bedfordshire, United Kingdom

Abstract:

How long the gas turbine (GT) engines can be kept in service safely during the project life amid harsh ambient temperatures and degradation without losing their salvage value has become a growing concern with the compressor station operators. The reason is that GT engines for natural gas transportation are always allowed to run for an extended period due to their economic benefits. Replacing a deteriorated engine is indeed a huge loss to the industry economically. One solution to this problem is to apply a life extension strategy for safely extracting maximum usage of the procured engines on the natural gas pipeline by investing in or predicting the actual number of GTs that can serve the entire project life without altering the initial pipeline design. Therefore, this paper considers how the impacts of time-based ambient conditions and degradation (fouling) will not only affect the engine performance but how it can influence the number of gas turbines to be used in 18 compressor stations over the entire life of the project at a controlled turbine entry temperature (TET). The capacity and the number of GT engines were selected and modelled in TURBOMATCH software based on the highest power of the gas compressor in each compressor station for the three seasons of the year. There are four degraded scenarios (Clean, optimistic, medium, and pessimistic) to be examined in each season of the year, with an implementation of a routine overhaul after a year's interval for a project life of thirty years. Depending on the season and scenarios, the results revealed that the number of engines utilised in each station varies due to different ambient conditions and degradation. The result further showed that the number of engines increases as the year increases, with a corresponding increase in degradation. The method and results in this research will help the investor and GT users improve engine reliability to ensure uninterrupted delivery of gas to the consumer.