The influence of reschedule-overhaul and degradation of gas turbine in determining the number of gas turbine usage in natural gas pipeline transportation network

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Gas turbine plant plays a significant role for compression of gas through the pipeline especially remote areas that is destitute of electricity. How long the Gas turbine (GT) engines can be kept in service safely during the project life in the midst of harsh ambient temperature and degradation, without removing them from operation has become a growing concern to engine life-cycle managers. Also, the need to balance risk and cost of replacing completely deteriorated engines explains the growing interest in the application of life extension technologies for safely extracting maximum usage of the procured engines on natural gas pipeline. This is because the engines are allowed to run for a long period of time due to the economic benefits of natural gas business. This paper present how rescheduling of GT overhaul from the baseline case and the timed-based degradation affects the number of GT to be used in a compressor station without altering the original pipeline design for a particular amount of gas throughput. Eighteen compressor stations with gas turbine as the driver to gas compressor is been investigated. TURBOMATCH, an in-house gas turbine modelling and performance simulation software was used to develop the selected engine models based on the public domain specifications of the engines at a controlled Turbine Entry Temperature (TET). Three seasons (Winter, Dry and Hot seasons) were considered in this paper based on the location of Trans-Saharan gas pipeline being investigated. compressor and turbine are degraded (fouled) as a single type of degradation producing three performance scenarios (Optimistic, medium and pessimistic). These scenarios define the levels of deterioration of the GT in comparison with the clean conditions. The baseline case indicated that at a controlled TET, the number of GT used in each compressor station increases with increase in degradation (reduction in flow capacity and isentropic efficiency) which result to a variation in the number of engines per station. The result here shows that implementation of reschedule-overhaul on the engines reduces the number of Gas turbine usage at the same degraded and ambient condition of the baseline case. In view of this, final result further indicated that, the optimistic, medium and pessimistic scenarios that used 99, 106 and 120 number of engines throughout the life of the engines for 18 compression stations at baseline reduces to 91, 104 and 115 respectively for the same amount of gas to be delivered and at the same operating conditions. The proposed approach will enhance engine life extension strategies that engine life-cycle managers or natural gas pipeline investors may adopt to cost-effectively manage their engines, while ensuring reliability and safety on the pipeline business.

Biography

Engr. Aziaka is a final year PhD researcher in the centre of Power and propulsion at Cranfield University, United Kingdom (UK). He obtained a Master's degree (MSc- Thermal Power specialising in Rotating Machinery Engineering) and Bachelor's degree (B-Tech- Mechanical Engineering) from Cranfield University, United Kingdom and the Rivers State University of Science and Technology, (Now Rivers state University) Nigeria, respectively. He belongs to several professional organisations both national and international bodies, which include a member, American Society of Mechanical Engineers (ASME) in the USA.

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