

TECHNO-ECONOMIC EVALUATION OF MECHANICAL CHILLER FOR POWER RECOVERY IN A GAS TURBINE UNIT IN NIGERIA

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ABSTRACT

The rated power output of a gas turbine is not realised when it operates at ambient conditions different from the rating conditions. Probably the most significant ambient condition in this regard is temperature with substantial losses in gas turbine performance attributable to it hence the need for gas turbine inlet air cooling in hot climes. In this paper, operation data from a gas turbine plant in Nigeria has been used to determine the variation of gas turbine power output with ambient temperature. Also, a techno-economic analysis of a suitable mechanical chiller for reducing intake air temperature has been carried out. It is found that for every 1⁰C increment in ambient air temperature above ISO standard temperature, gas turbine power output drops by 0.94%. Retrofitting the gas turbine with a mechanical chiller can potentially improve power output up to 20% with substantial financial gains including the capability of the system to pay for itself in under three years. Further, the upper limit of capital expenditure for the mechanical chiller installation to be profitable was determined. There is, therefore, an economically viable case for expanding the present power capacity of gas turbine plants in Nigeria through mechanical chilling of inlet air.

Keywords: Gas turbine performance, ambient temperature, inlet air cooling, economics.