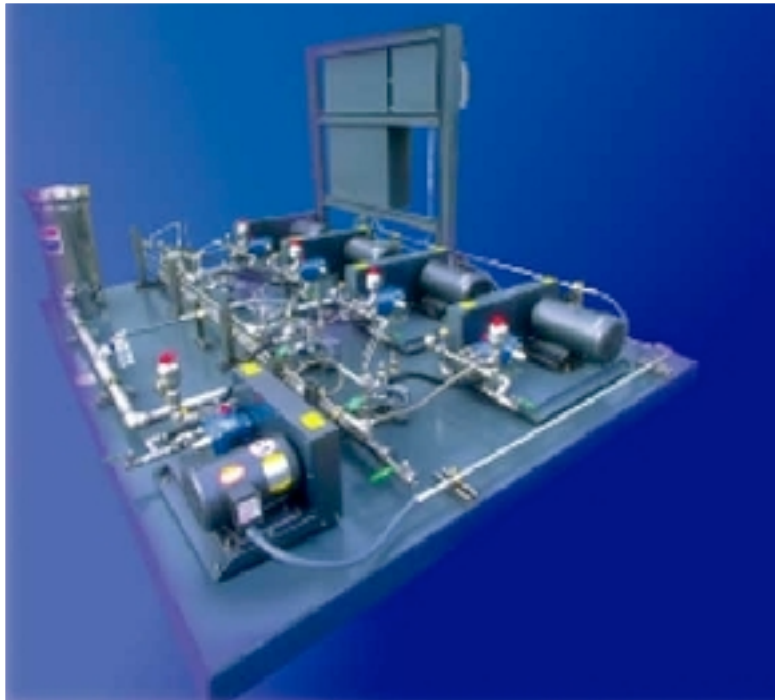




M E E I N D U S T R I E S
Monrovia, CA



Evaluation of a MeeFog system for an Industrial Trent power generation package

RB211 PACKAGE AT GULF PETROLEUM COMPANY

Evaluation of MeeFog on a Platform in the Persian Gulf

Background

Whitby Cogen are currently running with deteriorated engine ESN011/8. Deterioration of engine power, around 95% availability 500hrs post a compressor wash, has led the customer to investigate other ways in which to attain more power, especially during hot days. One suggestion that has been made is to install an air humidification (or fogging) system, a system that will almost saturate the ambient air. The affect of this system is to provide a cooler and more denser medium in which the gas turbine will use to generate more power on a specific day temperature. MEE FOG industries provides such a system. Figure 1 depicts schematically the way in which an evaporative cooling system works.

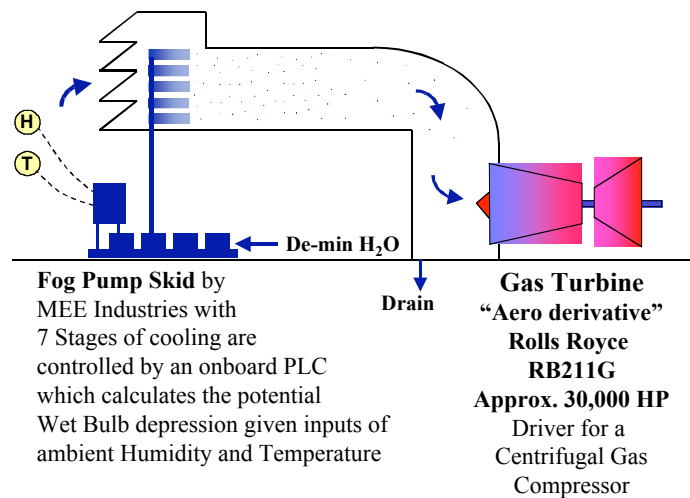
Mee Industries, Inc. has, through the authority of Rolls-Royce, installed a number of fogging systems into Rolls-Royce packages, with either an RB211 or Avon gas generator. In order to approve MeeFog equipment for installation into an Industrial Trent package, it has been requested to first evaluate the success of the system on other Rolls-Royce products. This note documents the technical evaluation of an RB211 which has had a MEE FOG system installed since 2001.

Evaluation

The evaluation of a MEE FOG system for incorporation into an Industrial Trent power generation package is based on the following limited data:-

1) The RB211 has completed 56,708 hrs TSN, with an estimated 25,000 hrs utilizing a MEE FOG system and has recently been overhauled at Rolls Wood Group (RWG). Reporting reveals no evidence of any water carry over, the major concern with a system of this nature. To note is the fact that both IP Compressor vanes and blades were observed to be 'quite dirty with black deposits'. This is contrary to the statement that the customer had noted that the fog system was also keeping the engine clean, implying a certain amount of water carryover.

Evaporative Cooling by Fogging – Figure 1



2) A graph depicting the change in facility gas output (proportional to power) with and without the fog system turned on clearly shows that from May 2003 to July 2003 an additional 6-7 mm SCFD was achieved with the fog system. 1 mm SCFD equates to 200 hp and therefore the power gain achieved was in the region of 1200-1400 hp, which equates to 0,894 – 1,044 MW. The mean daily ambient temperature in the Gulf between May and July is 30.5-34.4 deg.C respectively, with an average hu-

midity of 70% (from Figure 2). Reviewing the potential power gain with varying degrees of humidity on a 6562

package (figure 3) to estimate the potential power gain for 100% saturation gives 1.2 MW.

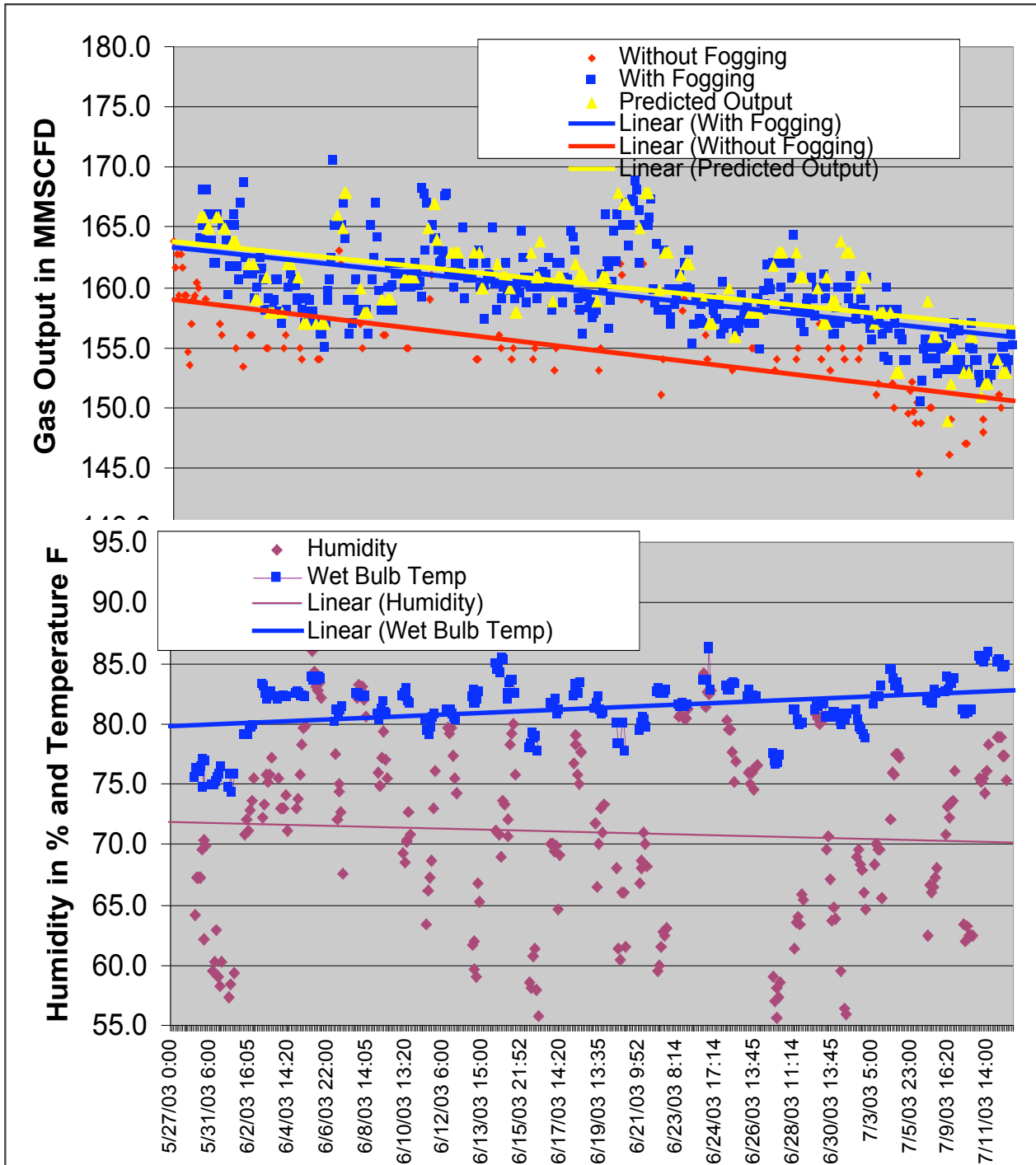


Figure 2. Depicts Gas Output with and without fogging, and the associated change in humidity and wet bulb temperature

Conclusion

Taking into consideration the limited evidence gathered in the above we can deduce that there is no water carryover into the gas turbine, supported by both the engine condition and that the amount of power gain observed seems to be lower than the predictions made for 100% humidity (suggesting that there is zero compressor inter-cooling through water evaporation).

It is therefore concluded that with the evidence gathered to date there seems to be no technical reason why a

MEEFOG system would be detrimental to the operation of an Industrial Trent gas turbine, with the assumption that the system is set up in a similar manner to the RB211 (as previously discussed).

