EMISSIONS

Gaseous Pollutant Emissions

OVERVIEW

Distributed generation (DG) such as MTGs offers an attractive strategy for meeting future demand for reliable, cost effective electrical energy. However, the widespread commercialization of these MTGs may be limited due to recently adopted regulations that require the emissions of criteria pollutants such as nitrogen oxides (NOx) and carbon monoxide (CO) to be on par with advanced central power stations. To quantify the criteria pollutants produce by these microturbines, the NOx and CO emissions from a commercial MTG is thoroughly characterized over its operational ranges

GOALS

- Instrument a commercial MTG with the appropriate sensors to measure the fuel flow rate, power output, ambient conditions and emissions console in accordance with EPA standard
- Quantify the pollutant emissions over a full range of operability
- Relate the emission characteristic with known combustion phenomenon

RESULTS

A Capstone C60 MTG was chosen because it is one of the most widely used commercial MTGs. The results show some interesting behaviors:

- Emission performances are superior at 80-100% load
- There are 5 distinct emission groups that corresponds directly to the staging strategy employed by Capstone
- Within a stage NOx increases and CO decreases
- Between stages both NOx and CO decrease with load, except for at less than 10% where CO level is order of magnitude smaller

However, when graph versus equivalence ratio, NOx shows the expected exponential dependency. CO, on the other hand, still have the heavy complete dependency on staging. Since the lowest CO emission occurs at the lowest local equivalence ratio, it is suspected some form of quenching is involved.

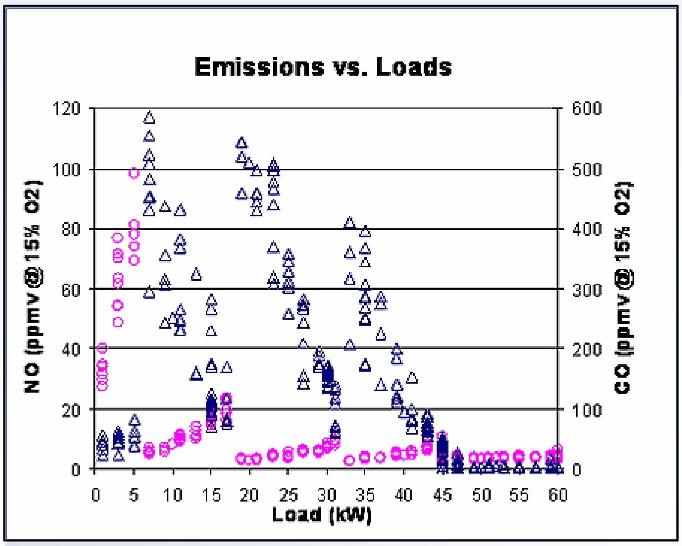

Figure 1. Emission as a function of loads

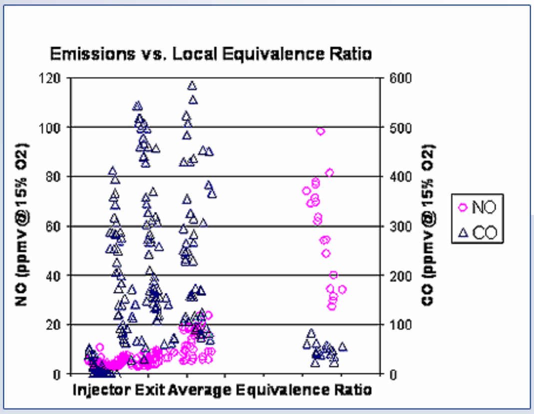

Figure 2. Emission as a function of local equivalence ratio

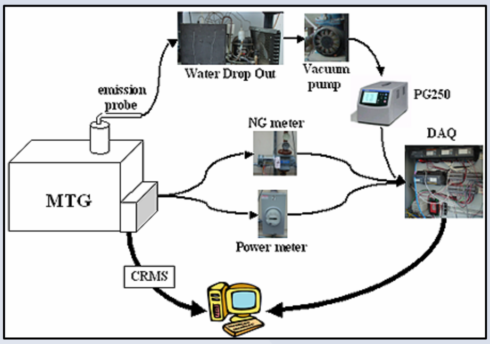

Figure 3. Experimental Setup

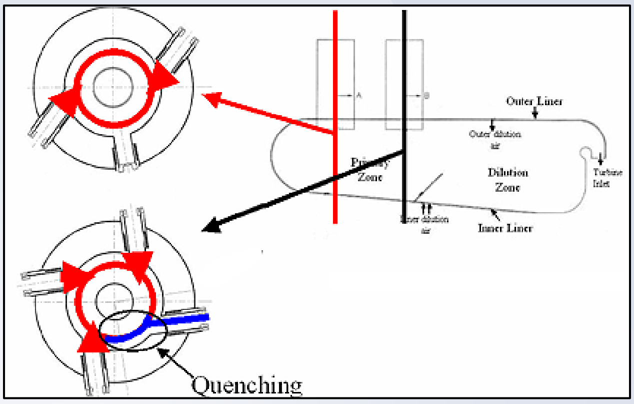

Figure 4. Illustration of the quenching effect from the staging

RECENT PUBLICATIONS/PAPERS

CHARACTERIZATION OF EMISSIONS AND FUEL INJECTION PERFORMANCE FOR A COMMERCIAL MICROTURBINE GENERATOR. Paper 03F-22. Presented at the Fall Meeting of the Western States Section of The Combustion Institute, Los Angeles, CA, 20 October. V.M. Phi, J.L. Mauzey, V.G. McDonell, and G.S. Samuelsen (2003).

FUEL INJECTION AND EMISSIONS CHARACTERISTICS OF A COMMERCIAL MICROTURBINE GENERATOR. Paper GT-2004-54039. ASME Turbo Expo: Power for Land, Sea and Air. Vienna, Austria, 14-17 June. V.M. Phi, J.L. Mauzey, V.G. McDonell, and G.S. Samuelsen (2004).

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