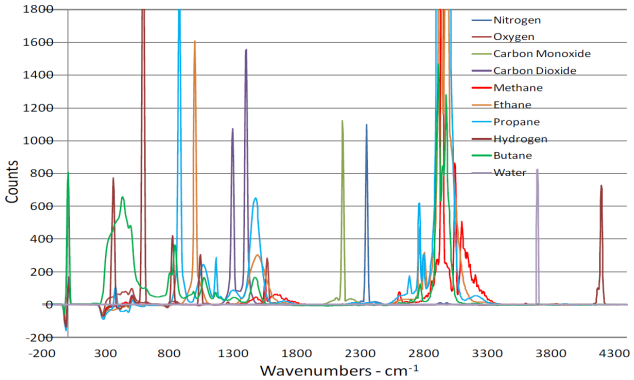
Continuous Natural Gas or Gas Blends Analysis with Raman Spectroscopy



Raman spectra of natural gas components

- Raman spectroscopy provides significant advantages relative to current natural gas analytical approaches, which are relatively expensive and not continuous.
- Potential future natural gas blends to reduce carbon emissions may require more timely analyses of gas blends.
- Project results will help identify best practices surrounding efficient Raman spectroscopy natural gas monitor implementation.

Key Research Question

Gas turbines (GTs) represent a large percentage of global power generation, producing low-cost electricity, helping comply with regulations for criteria pollutants, and providing dispatchable load-following capabilities. As a step toward decarbonizing the power sector, GT OEMs are developing combustion systems for hydrogen, ammonia, and natural gas fuel blends. To facilitate operation of GTs on low-carbon fuel blends while maintaining performance and environmental standards, it will be important to understand the real-time fuel composition upstream of the combustor to optimize combustion and limit the impacts of fuel variation.

Examples of current onsite natural gas analysis instrumentation include gas chromatographs (GCs) for composition and Wobbe Index (WI) meters for heating value and density. However, analyses with these instruments are not continuous, taking from 5–10 minutes to complete, depending on the scope of species measured and GC column and operating configuration applied.

Advanced fuel sensors and instrumentation will be needed to enable GT operators to measure the composition of hydrogen, ammonia, and natural gas fuel blends in real time.

Objective

The current project focuses on the installation and demonstration of a commercial Raman spectrometer at a natural gas-fired host site over a nominal, one-month time period with the primary objectives of defining installation requirements, system operability and accuracy, and operating costs relative to alternative measurement technologies for natural gas analysis.

Approach

The project team will work with each participant host site to define natural gas pipeline properties (e.g., pressure and temperature) at the proposed installation location. A Raman spectroscopy monitor installation plan will be prepared in coordination with the host site. The project team will then work with the host site to install the Raman spectroscopy probe and connect the Raman spectroscopy probe signal via fiber cable to the monitor located within a temperature-controlled shelter in relatively close proximity (i.e., <150 feet). Independent natural gas analyses will be obtained on a frequency agreed upon by the host site and obtained from their natural gas supplier, via onsite analysis using a GC, or through other means. Results will be compared to Raman spectroscopy natural gas analyses obtained at the same time.

Research Value

Completion of the project scope is intended to provide the necessary data for project funders to better understand installation locations and requirements for Raman spectroscopy natural gas monitors. Public benefits from this project may include improved gas turbine operation and reduced emissions, as well as increased efficiency in obtaining natural gas analytical measurements through use of Raman spectroscopy.

Deliverables

Each project host site will be invited to participate in a webcast to review the site installation location and requirements, monitor operating characteristics, and review periodic comparisons of Raman spectroscopy natural gas measurement results relative to alternative host site measurements. Project results will summarize the host site natural gas delivery properties, Raman spectroscopy probe installation procedures, operating conditions, test approach, and readings obtained.

Price of Project

The project cost for a field assessment of natural gas analysis using Raman spectroscopy is estimated at $30,000 for each host site. The project qualifies for Self-Directed Funding (SDF) and Tailored Collaboration.

Project Schedule

Initiation of the project is subject to attainment of a host site, with the anticipated initial project scope and schedule to be completed by June 30, 2023.

Who Should Join

Gas turbine generation owners with CEM monitoring requirements could benefit from participation in this project.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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