

GE
Oil & Gas



Get a better view

Predictive Emissions Monitoring System (PEMS) for gas turbines



What it is

Government regulations worldwide require gas turbine operators to measure the concentration of CO, NO_x and O₂ in their exhaust stack emissions. There are three ways of doing this:

- manual measurement (CEMS methods)
- statistically-based PEMS methods
- model-based PEMS methods

The PEMS model-based approach employed by GE's Oil & Gas business provides highly accurate, continuous data on emission levels at the lowest cost.

How it works

Instead of expensive sampling of the stack exhaust, the PEMS predictive model continuously computes the composition of emissions in the turbine exhaust gas by feeding parameters available from the gas turbine control system (e.g., turbine temperatures, pressures, and speed; ambient temperature, pressure, and humidity; and fuel characteristics and flow) into a proprietary GE thermodynamic model. The results are displayed as a trend plot and archived on a PC.

The PEMS advantage

GE's PEMS utilizes modeling techniques based on 'first principles'. It employs equations that represent the various mass and energy balances and thermo-kinetic reactions that characterize the combustion process. Unlike statistical-based approaches which actually make their predictions using data sampled periodically, first-principles models use sample data only to calibrate or tune the model to the specific turbine and fuel being measured. The tuning process adjusts the model coefficients by pairing observed emissions with observed turbine input parameters.

Regulatory compliance

In the past few years, PEMS has undergone rigorous testing mandated by various environmental agencies around the world for certification. It is now approved by more than 30 of them as an alternative to conventional – but considerably more expensive – Continuous Emissions Monitoring Systems (CEMS).

Applicability

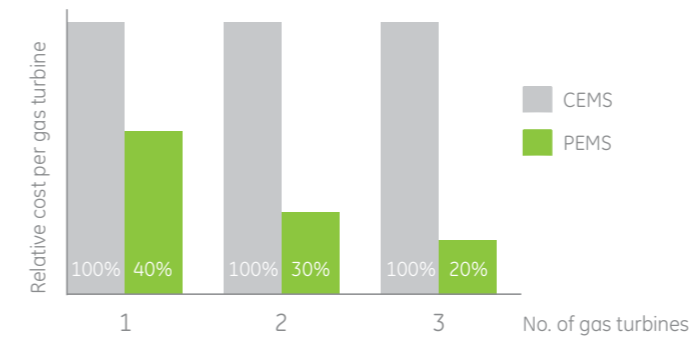
PEMS is available for the entire range of GE gas turbines under 40 MW, operating under all conditions and in any application.

Efficient, effective monitoring

Set-up and operating costs for PEMS are as much as 80% less than those of traditional monitoring systems with physical sensors because there is no need for exhaust gas sampling procedures or specialized personnel.

No stack-mounted hardware is required, and a single PEMS can be configured to simultaneously monitor multiple turbines (see graph below).

Capital + operating cost/unit



Note: estimates do not include certification testing

The system does not require the calibration of hardware needed by measurement-based systems since it calculates emissions based on absolute input values rather than relying on standard measurement practices.

The absence of external and peripheral equipment makes PEMS ideal for off-shore applications and other operations with logistical or physical limitations.

PEMS is easily integrated with GE's Smart Services platform which includes Remote Monitoring & Diagnostics and Remote DLN Tuning.

Case study

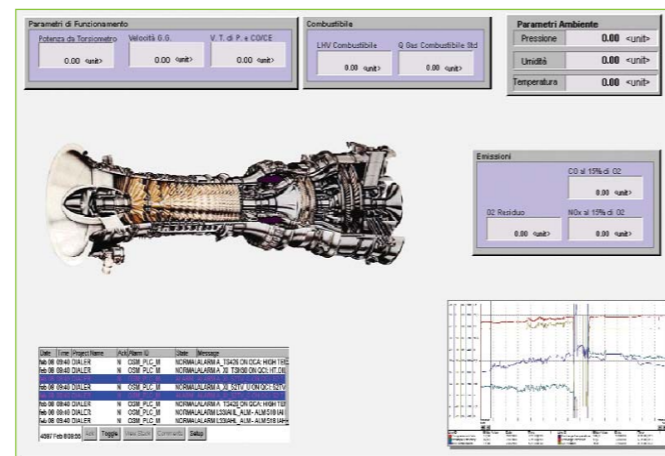
When a European gas pipeline customer came to us for an alternative to CEMS in their new pumping station, we proposed PEMS. The key rationale was considerable cost savings. A CEMS installation can typically amount to a significant proportion of the cost of a 10-MW turbine itself. In this case, a single PEMS could cover all three of their GE10/2 gas turbines for a much lower cost than that of the three CEMS units that would have been needed.

Initially, both the customer and the regulatory agency questioned this recommendation, even though GE had experience with both types of units. To address the concerns that had been raised, we initiated a program at the customer's site, demonstrating the viability of PEMS and its accuracy compared to that of CEMS.

PEMS was subsequently approved and installed. After 8,000 hours in service, and bi-annual and spot tests by the customer, PEMS has been proven to operate without problems or maintenance, and its NO_x predictions agree with measured values to well within 5 ppm.

The value and reliability of PEMS was demonstrated on one occasion when it detected an increase in emissions that put the turbine slightly out of compliance. A traditional emission measurement confirmed the increased NO_x level and further investigation found that the deviation was a result of a malfunctioning pilot valve and servo. Once the hardware problem was corrected, the unit was put back online and the emission level was compliant again.

Technology that lets your business run free



Nuovo Pignone S.p.A.
Via Felice Matteucci, 2
50127 Florence, Italy
T +39 055 423 211
F +39 055 423 2800

www.ge.com/oilandgas

The information contained herein is general in nature and is not intended for specific construction, installation or application purposes. GE reserves the right to make changes in specifications or add improvements at any time without notice or obligation.

©2005 General Electric Company
All Rights Reserved

