

Industrial Technologies Program

Rotary Burner Technology Demonstration (Phase 1)

New Rotary Burner Saves Energy and Reduces Emissions

A new Calcpas rotary burner (CRB), using the available fuel gas pressure as a free source of drive energy, eliminates electric motors, providing a simple, cost effective means of retrofitting existing fired heaters for energy and environmental reasons. By virtue of its inherent, superb mixing capability, the CRB also provides a high performance, ultra-low emissions burner enhancing heat transfer effectiveness, thus reducing energy use. A laboratory tested prototype of 10.6 million Btu per hour capacity operating at 3.4% O₂ produced a compact flame with NO_x and CO emissions less than 1.0 and 2.0 ppmv respectively. This performance will typically result in energy savings of 5.0% compared to current fired heaters. Efficiency-degrading flame

impingement and tube fouling are also eliminated with the CRB. Additional operational improvements in basic rotary burner technology include increased combustion stability, innovative fan and pilot ignition design, and compact geometry to facilitate on-the-fly heater conversion.

Benefits for Our Industry and Our Nation

- Reduced energy use
- Elimination of CO and NO_x emissions
- Easy and cost-effective retrofitting of existing fired heaters

Applications in Our Nation's Industry

A successful Calcpas rotary burner will enable cost-effective retrofitting of gas burners in the refining industry, satisfying the most stringent current and future emission standards. This technology is also applicable in chemicals production, natural gas processing, and similar applications.

Retrofit Burner



Diagram of the control technology that enables very low excess air in process heaters.

Project Description

Goal: To perform a 4,000 hour life test on a single burner CRB prototype to determine the energy savings, reduction of NOx and CO emissions, and the overall performance. The results of this project (Phase I) will satisfy all safety and reliability issues.

This project will be a joint venture, with Calpos Engineering responsible for the project success and technology commercialization. Gas Consultants Incorporated supervised the earlier prototype test and will contribute their working knowledge of the CRB to the field test. Equilon LLP; Shell/Texaco Group will provide test locations as well as industrial input during the design stage, eliminating costly revisions at a later date. Precision Manufacturing will coordinate all manufacturing engineering activities, maintaining complete test hardware drawings. Calpos will also participate in the design team.

Milestones

- A Complete quality control (QC) baseline test was done prior to site installation.
- Data acquisition methods and special site and proprietary requirements were confirmed. A water-cooled sample probe and a camera were used to gather operating data and 2 burners for use in phase II tests had incorporated site-recommended modifications.
- Heater operating data was obtained prior to installation of the CRB. At the design point rate of energy delivery, the CRB demonstrated improved heat transfer rates, better energy efficiency, and reduced emissions of carbon monoxide and nitrogen oxides compared to existing burners. Pilot ignition and main flame stability were excellent and no mechanical overheating was experienced.
- Commissioning and some

adjustments of the CRB were completed. Burner #1 was commissioned and installed in June, 2002, followed by burners #2 and #3 (which have the site-recommended modifications) in October, 2002.

- All three installed burners have been running, without maintenance or special attention, since the installation date continuously and without problems as of the publication of the final report.

Project Partners

Calpos Engineering
Northfield Center, OH

American Petroleum Institute
Washington, DC

Equilon LLP; Shell/Texaco
Houston, TX

Gas Consultants Incorporated
Walton Hills, OH

Precision Manufacturing
Binghamton, NY

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy
Energy Efficiency
and Renewable Energy

July 2003