

IMPROVED FIRE-TUBE IMMERSION HEATER EFFICIENCY PROJECT

EXECUTIVE SUMMARY

Background

The Upstream Oil and Gas Industry is an energy intensive industry. The industry is required to consume significant amounts of energy to process raw gas and liquids to either a finished or semi-finished product of sales gas, LPG's, sulphur and oil or condensate. This energy requirement is commonly referred to as the Production Energy Intensity (PEI). One specific area that is of common concern to many upstream operating companies is the energy consumption associated with immersion heaters. The energy often used to fire these heaters is high quality refined sales gas. In 1979 a study estimated that in Alberta line-heaters and treaters consumed 70 Bcf/A in fuel gas, which is equivalent to 8 billion BTU/hr, at a cost in excess of \$320 million/A.

A common problem with the immersion heaters is that they may have low fuel efficiencies between 30% and 60%. Compared to common boiler technology these heaters should be able to run at between 70 to 80% efficiency. Even when taking into consideration the cyclic nature of operation associated with many of the applications, these heaters currently waste in excess of 2 to 3 billion BTU/hr of fuel (1360 to 2040 e3m3/d gas) that could be conserved to generate added sales. At an average cost of \$5/GJ this represents \$100 to \$150 million of lost revenues due to inefficient use of fuel gas. This also represents an associated 1.5 million additional tonnes of carbon dioxide being discharged into the atmosphere per year.

Often lower heater efficiencies are associated with high levels of oxygen or combustibles and high stack temperatures. These can result from poor burner performance and poor control of combustion air or improper configuration or the size of the fire-tube. Unlike steam or hot water boiler practices of efficiency calculations and guarantees, the efficiencies of immersion heaters are rarely considered during a typical specification, design, manufacturing, or operation cycle of the equipment.

Requirement

Taking under consideration rising fuel costs and more stringent environmental regulations, there is a requirement for improvements in the evaluation, design, operation and maintenance practices leading to low efficiencies of immersion heaters.

Project Sponsors

Arriving at new design standards and operating parameters, while sharing in the financial and resource investment burden, is essential to improved efficiency. BP Canada Energy, EnCana, Husky Energy, Nexen, Petro-Canada and CETAC – West have all contributed toward this project.

Resulting Request For Proposal (RFP)

The Request for Proposals (RFP) for Improving Fire-Tube Immersion Heater Efficiency (RFP EETR 0401) was issued in May as a direct result of the Technology for Emission Reduction and Eco-Efficiency (TEREE) Steering Committee meeting held in April.

The RFP included the following scope of work specification:

- review of historical design data, current industry practices and the study of burner and fire-tube designs and their associated efficiencies.
- develop theoretical heat transfer, combustion calculations and computer modeling to optimize the designs.
- perform actual firing tests to confirm the new results
- develop a general industry design and performance standard for these heaters as a requirement for bids on all future equipment.
- develop an education component to improve the level of understanding within the industry, as it applies to the design of new equipment, the improvement to existing equipment and to provide tools for operating companies to achieve and sustain improved performance

For further background information on the RFP, please visit www.ptac.org/eet/eetr0401.html.

The work would require the support of operating company members and potentially the assistance of independent third party outside technical expertise for technical support. Project performers will work under the technical direction of the TERE Immersion Heater Efficiency working group.

A number of proposals were received from leading experts in the field of combustion and heat transfer including consulting engineering firms, universities and research labs and equipment manufacturers.

A panel of petroleum industry experts reviewed the submitted proposals in July and chose ENEFEN Energy Efficiency Engineering Ltd. to provide a more efficient and cost-effective way to address the problem of inefficient immersion tube heaters. The work is now underway.

Current Project

To address the RFP requirements, ENEFEN brought together three expert groups to perform this contract:

- ENEFEN Energy Efficiency Engineering Ltd. – provides project management, combustion systems and controls design, field testing, and report writing expertise
- COEN Company – with world class expertise in combustion modeling, burner design and radiative and convective heat transfer solutions – develops immersion tube rating software and consulting support for the heat transfer and burner design evaluation
- PITS Petroleum Industry Training Service – provides fully instrumented testing facilities in Nisku, AB for burner and tube testing and software calibration testing, as well as an expertise in developing an industry training concept for this project.

ENEFEN project includes the following tasks:

- Literature survey
- Applicable technology identification
- Fire-tube rating software development (COEN)
- Field performance data collection
- Lab (PITS) heater performance data collection
- Comparative burner tests
- Selected burner testing in the heater (PITS)
- Rating software calibration
- Control system design
- Fire tube design guideline development
- Test and research results documentation
- Training program concept development

Future Benefits

The main benefits of this project will include:

- Rating software for immersion tube evaluation and design tested and calibrated on real heater applications.
- Industry guideline for evaluation, design, operation and maintenance of immersion heaters aimed at maximizing their efficiency
- Practical and economical solutions to existing heater improvements
- Training program concept to improve the level of understanding within the industry, as it applies to the design of new equipment, the improvement to existing equipment and to provide tools for operating companies to achieve and sustain improved performance.

Access to Project Results

Project sponsors will have access to the project results for up to one year prior to public release. The results once published, would be made available in the public domain. This eliminates alignment to any vendor or manufacturer specifications.

If you would like to participate in this project as a sponsor, please contact:

Ralf Aggarwal, Technology Transfer Coordinator
PTAC Petroleum Technology Alliance Canada
Suite 700, Chevron Plaza, 500 Fifth Avenue SW Calgary, AB T2P 3L5
phone 403 218-7711, fax 403 920-0054, email: ragnarwal@ptac.org, web: www.ptac.org
