



IGS HELPS INCREASE THERMAL EFFICIENCY BY 3% AT TÜPRAŞ IZMIR REFINERY



This refinery located in Turkey applied Cetek's High Emissivity Coating followed by Tube Tech's convection section cleaning service to achieve several operational benefits, which are discussed in this case study overview.

THE CHALLENGE

The plant was experiencing reduced radiant heat transfer efficiency, higher fuel consumption and an increase in flue gas temperature of its steam methane reformer (SMR). The problems arose from the adsorbents in a Pressure Swing Absorption Unit, part of the refinery's Hydrogen Manufacturing Unit (HMU), being changed during a turnaround.

Once started up, some of these adsorbents were transported by the tail gas stream and facilitated by misplaced screens in one of the beds; the result was an accumulation of fouling on the convection bank tubes of the SMR.

THE SOLUTION PART ONE:

Increasing SMR Radiant Heat Transfer Efficiency

In the SMR, the burners are directed to the angled walls in the radiant sections and the radiation is transferred to the process tubes. The efficiency of the radiant heat transfer is related to the emissivity of the refractory surfaces. The higher the emissivity value, the greater the radiant heat transfer efficiency.

The application of a Cetek high-emissivity coating onto the refractory surface in 2014 increased the amount of heat re-radiated to the process tubes in the radiant section. As a result, more heat is absorbed by the tubes, and less heat travels to the convection section, slightly decreasing steam production.

Post Coating Evaluation

Tüpraş report that the bridgewall temperature has decreased by 26°C, a positive indication that the high emissivity ceramic coating is performing well. The amount of heat transferred to the radiant section has increased by 2.9% leading to the reported decrease in energy consumption of 6.8% (released) and 8.3% (absorbed).

Economic Returns

The application of Cetek high-emissivity refractory coating has helped the refinery achieve targeted fuel savings, pay-out and return on investment. The coating continues to deliver benefits for approximately two turnarounds or eight years. After this period, it may require reapplication to continue delivering fuel savings or increased capacity benefits.

THE SOLUTION PART TWO:

Restoring Convection Section Heat Transfer Efficiency

To increase heat transfer and therefore absorb more energy in the convection section of the furnace, the decision was taken to carry out mechanical cleaning. In addition, and as further motivation for the project, since the first start-up of the unit, no mechanical cleaning had been carried out in the convection tubes due to their inaccessible locations.

In 2017, Tüpraş contacted Tube Tech to deploy its robotic convection section fouling removal robot. The technology works remotely by penetrating deep between tube rows to remove even the most tenacious fouling deposits.

RESULTS

The fired heater robotic fouling removal services provided by Tube Tech removed extremely hard deposits deep within every tube row and provided before, during and after inspection reports.

Hydrogen Production Cost and Payback Period

The average cost of hydrogen production before and after cleaning was calculated at \$943.90 and \$919.30 per ton. The production cost of hydrogen decreased by \$24.6/t after

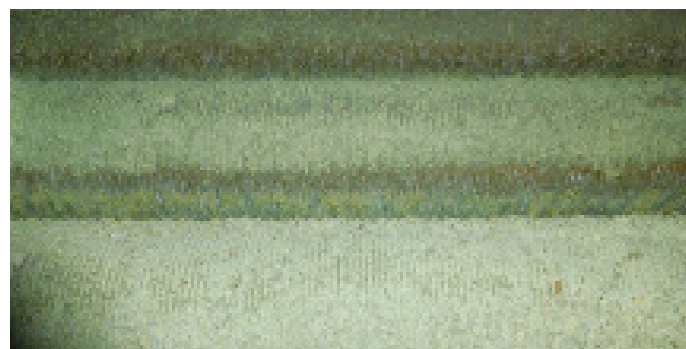
cleaning and the payback period for the project was less than 60 days..

Flue Gas Temperature

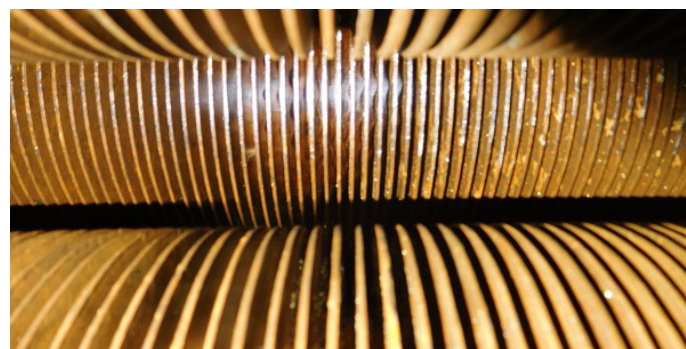
The average stack temperature decreased from 278°C before cleaning to 220°C after cleaning, meaning that the furnace's overall thermal efficiency increased by approximately 3%.

Steam Production

Steam production increased by approximately 20%, and the superheated steam temperature increased by 10-15°C.



Before cleaning the uppermost bank economiser



After cleaning the uppermost bank economiser



The IGS Surface Solutions Package

Cetek high emissivity coatings and Tube Tech robotic convection section cleaning are great ways to increase the efficiency of a fired heater. Applied together, they help to leverage the overall benefits. IGS has extensive experience in turn-key project execution in all parts of the world.

Is your facility suffering from reduced output? Contact our team today at info@integratedglobal.com for expert advice and tailored solutions across a range of industries and applications.



This information is an extract from technical articles published by the Tüpraş İzmir Production Sustainability Manager, Combustion Superintendent, and Process Superintendent in PTQ Q3 2020, and PTQ GAS 2022 read the article in full: