

## UNITED PROCESS CONTROLS EXPLORES HOW STEEL PROFILES PRODUCERS CAN OVERCOME SOME OF THE ISSUES ASSOCIATED WITH COSTS, QUALITY AND ENVIRONMENT.

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The Oxyfire™ In-Situ Zirconia Oxygen Sensor is designed to measure excess oxygen in combustion processes

The real time, in-situ measurement of excess oxygen and temperature in the radiant heat zone of a boiler or furnace provides a window for viewing combustion conditions closest to the source. Excess oxygen and temperature measurements, taken at strategic sample points around the fire-box, provide timely information for optimal trim control of the combustion process. With a focus on fuel costs and NOx emissions, it is essential that the excess oxygen measurement be fast and accurate.

Combustion is the rapid combination of oxygen with a fuel resulting in the release of heat. In most combustion processes the oxygen comes from air. Unfortunately, only 20.9% of air is oxygen. Nitrogen and other non-combustible gases make up the other 79.1%. These gases are detrimental to the combustion process because they must be heated, thus creating thermal loss.

Ideal combustion minimizes the thermal loss and the amount of NOx produced. However, the reality is that most combustion processes use excess oxygen. A combustion may run with high levels of excess air (oxidizing) and still heat the billets. The

excess air contributes to pollution (NOx) and causes quality defects: metallurgical and high scaling. On the other hand, running at too low a level of excess air (reducing) creates problems at the other end of the spectrum. Insufficient oxygen causes raw fuel to flow up the stack. This situation creates waste and air pollution, damages the refractory and contributes to quality defects. In most combustion processes, it is safest to operate with excess oxygen, and additionally the total amount of wasted fuel is reduced.

Combustion efficiency plays a major role in the overall performance of the process, when energy is a significant operation cost. Fuel savings and NOx reduction can be estimated using general rules of thumb. Burner manufacturers estimate a fuel savings of 1% for every 1% reduction in excess oxygen at a flue temperature of 1200°F (649°C). At higher temperatures even greater fuel savings are possible. The North American Manufacturing Handbook supplement provides the information necessary to calculate exact savings. It has been documented that a 1% reduction in excess oxygen equates to a 20% reduction in NOx output. This is a linear function, thus a 2.5% excess oxygen reduction would result in a 50% reduction in NOx.

The financial justification for using oxygen sensors to minimize excess oxygen is presented next in a case study. Cost savings owing to fuel reduction can be quantitated. Total Cost of Ownership calculations along with the cost savings calculation results in potential payback and Return On Investment (ROI) predictions. Empirical data is used to correlate the expected NOx reduction associated with excess oxygen reduction.

Commercially available in-situ, high temperature oxygen sensors have the potential to solve combustion control and burner management problems with short payback and high annual ROI in steel, glass, power, petrochemical and refining applications.

## CASE STUDY

For over four decades Process-Electronic, a member of United Process Controls Inc. (UPC), has worked with clients throughout the world to achieve their upgrade goals in combustion and heat treatment.

In 2014, BGH Polska Sp. z o.o., a subsidiary of BGH Edelstahlwerke GmbH Deutschland, a major European producer of steel profiles, sought to optimize the combustion operation and efficiency of a walking beam hearth furnace ordered from LOI Poland Sp. z o.o., a subsidiary of LOI Themprocess GmbH, a member of Tenova Group Italy.



Investing in the modernization of a combustion system for a steel reheating furnace gives BGH major savings in fuel consumption

The BGH team optimised the furnace design by using a UPC OxyFire™ excess oxygen system. Mr. Waldemar Szuba, Hot Rolling Production Manager, had this to say about the success of the project:

“We have measured the positive impact to gas consumption, and thanks to the Oxy-Fire™ and new burners supplied by LOI, we have achieved a 5% natural gas savings, as well as lower maintenance and **reduced scale formation**. Based on our average production rate of 28,000 kg/hr (61,730 lbUK/hr), 47 m<sup>3</sup>/t (4.7 galUK/lbUK) and 12 working hours a day, **the modernization gave us savings in natural gas of 23,670 m<sup>3</sup> (ca 5,200,000 galUK) per month**. In the last few years, BGH has worked diligently to continuously improve our operations in terms of controlling the combustion process. The new optimization system designed and supplied by LOI and UPC has brought many hard and soft advantages in costs savings, quality and environment issues. To enable our facility operators to work autonomously, users received comprehensive training and support from LOI and UPC field experts during the installation and commissioning. Following installation, the system was fine-tuned by users to our specific operating conditions – a very important part of the set-up process. While the initial settings were configured by LOI and UPC, we had the ability to further optimize the system performance with online data and hands-on experience from our facility operators. Confident with the results we’ve experienced, we now operate the furnace and the control system autonomously, and continue to realise real financial and operational benefits.”

**Waldemar Szuba**  
BGH Hot Rolling Production Manager

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